

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
15 January 2004 (15.01.2004)

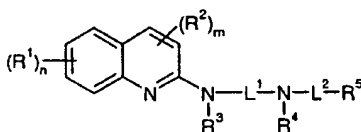
PCT

(10) International Publication Number
WO 2004/004726 A1

- (51) International Patent Classification⁷: A61K 31/47, C07D 215/38, 409/12, 401/12, 407/12, A61K 31/4709, A61P 3/04, 25/00
- (21) International Application Number: PCT/GB2003/002884
- (22) International Filing Date: 4 July 2003 (04.07.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 0202134-3 8 July 2002 (08.07.2002) SE
- (71) Applicant (for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CY, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, FR, GB, GD, GE, GH, GM, GR, HR, HU, ID, IE, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only): ASTRAZENECA AB [SE/SE]; Sodertalje, S-151 85 (SE).
- (71) Applicant (for MG only): ASTRAZENECA UK LIMITED [GB/GB]; 15 Stanhope Gate, London, Greater London W1K 1LN (GB).
- (72) Inventors; and
(75) Inventors/Applicants (for US only): RAY, Asim, Kumar [IN/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). SIGFRIDSSON, Emma, Margareta [SE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). LINUSSON, Anna, Stina, Maria [SE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). SANDBERG, Pernilla, Marie [SE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). INGHARDT, Tord [SE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). SVENSSON, Anette, Marie [SE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE). BRICKMANN, Kay [DE/SE]; AstraZeneca R & D Mölndal, S-431 83 Mölndal (SE).
- (74) Agent: ASTRAZENECA; Global Intellectual Property, Mereside, Alderley Park, Macclesfield, Cheshire SK10 4TG (GB).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

[Continued on next page]

(54) Title: MCHIR ANTAGONISTS



(I)

(57) Abstract: The present invention provides compounds of formula (I), wherein R¹ represents a C₁₋₄alkoxy group optionally substituted by one or more fluoro or a C₁₋₄alkyl group optionally substituted by one or more fluoro; n represents 0 or 1; R² represents a C₁₋₄alkyl group optionally substituted by one or more fluoro or a C₁₋₄alkoxy group optionally substituted by one or more fluoro; m represents 0 or 1; R³ represents H or a C₁₋₄alkyl group; L¹ represents an alkylene chain (CH₂)_r in which r represents 2 or 3 or L¹ represents a cyclohexyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclohexyl group either via the 1,3 or the 1,4 positions of the cyclohexyl group or L¹ represents a cyclopentyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclopentyl group via the 1,3 position of the cyclopentyl group and additionally when R⁵ represents 9, 10-methanoanthracen-9(10H)-yl the group -L¹-N(R⁴)- together represents a piperidyl ring which is linked to L² through the piperidyl nitrogen and to N-R³ via the 4 position of the piperidyl ring with the proviso that when R⁵ represents 9, 10-methanoanthracen-9(10H)-yl then r is only 2; R⁴ represents H or a C₁₋₄alkyl group optionally substituted by one or more of the following: an aryl group or a heteroaryl group; L² represents a bond or an alkylene chain (CH₂)_s in which s represents 1, 2 or 3 wherein the alkylene chain is optionally substituted by one or more of the following: a C₁₋₄alkyl group, phenyl or heteroaryl; R⁵ represents aryl, a heterocyclic group or a C₃₋₈cycloalkyl group which is optionally fused to a phenyl or to a heteroaryl group; as well as optical isomers and racemates thereof as well as pharmaceutically acceptable salts, thereof; with provisos, processes for preparing such compounds, their use in the treatment of obesity, psychiatric disorders, cognitive disorders, memory disorders, schizophrenia, epilepsy, and related conditions, and neurological disorders such as dementia, multiple sclerosis, Parkinson's disease, Huntington's chorea and Alzheimer's disease and pain related disorders and to pharmaceutical compositions containing them.



(84) **Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MCHIR ANTAGONISTS

Field of invention

5 The present invention relates to certain *N*-cycloalkyl, aryl or heteroaryl *N'*-quinolin-2-yl alkyldiamines of formula I, to processes for preparing such compounds, to their use in the treatment of obesity, psychiatric and neurological disorders, and to pharmaceutical compositions containing them.

10 Background of the invention

Melanin concentrating hormone (MCH) is a cyclic peptide that was first isolated from fish over 15 years ago. In mammals, MCH gene expression is localised to the ventral aspect of the zona inserta and the lateral hypothalamic area (Breton et al., Molecular and Cellular Neurosciences, vol. 4, 271-284 (1993)). The latter region of the brain is associated with the
15 control of behaviours such as eating and drinking, with arousal and with motor activity (Baker, B., Trends Endocrinol. Metab. 5: 120-126(1994), vol. 5, No. 3, 120-126 (1994)). Although the biological activity in mammals has not been fully defined, recent work has indicated that MCH promotes eating and weight gain (US 5,849,708). Thus, MCH and its agonists have been proposed as treatments for anorexia nervosa and weight loss due to
20 AIDS, renal disease, or chemotherapy. Similarly, antagonists of MCH can be used as a treatment for obesity and other disorders characterised by compulsive eating and excessive body weight. MCH projections are found throughout the brain, including the spinal cord, an area important in processing nociception, indicates that agents acting through MCH1r, such as compounds of formula I, will be useful in treating pain.

25

Two receptors for MCH (MCH1r (Shimomura et al. Biochem Biophys Res Commun 1999 Aug 11;261(3):622-6) & MCH2r (Hilol et al. J Biol Chem. 2001 Jun 8;276(23):20125-9)) have been identified in humans, while only one (MCH1r) is present in rodent species (Tan et al. Genomics. 2002 Jun;79(6):785-92). In mice lacking MCH1r, there is no increased
30 feeding response to MCH, and a lean phenotype is seen, suggesting that this receptor is

responsible for mediating the feeding effect of MCH (Marsh et al. Proc Natl Acad Sci U S A. 2002 Mar 5;99(5):3240-5). In addition, MCH receptor antagonists have been demonstrated to block the feeding effects of MCH (Takekawa et al. Eur J Pharmacol. 2002 Mar 8;438(3):129-35), and to reduce body weight & adiposity in diet-induced obese rats
5 (Borowsky et al. Nat Med. 2002 Aug;8(8):825-30). The conservation of distribution and sequence of MCH1r suggest a similar role for this receptor in man and rodent species. Hence, MCH receptor antagonists have been proposed as a treatment for obesity and other disorders characterised by excessive eating and body weight.

10 US 3,020,283 discloses that certain *N,N'*- bis lepid-2-yl 1,x-diamino C_{1-x} alkanes where x is an integer from 2 to 12 and *N,N'*- bis lepid-2-yl diaminocycloalkanes are useful as anthelmintics.

US 5,093,333 discloses certain *N*- substituted (cyclicaminoalkyl) 2-aminoquinolines which
15 are useful for treating hypofunction of the cholinergic system and therefore useful in treating dementias involving the cholinergic system.

US 4,203,988 discloses certain pyridinyl and quinolinyl ureas which are useful in treating gastric secretion.

20

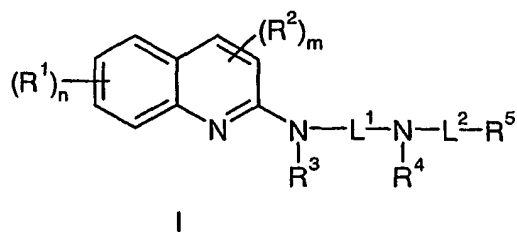
WO99/55677 discloses 2-(aminoalkylamino)quinolin-4-ones which are useful as anti-bacterial agents.

WO02/58702 discloses substituted 2-(aminoalkyl amino) quinolines which are antagonists
25 of urotensin II which are alleged to be useful in treating cardiovascular diseases characterised by excessive or abnormal vasoconstriction and myocardial dysfunction and also in diseases of the CNS for example addiction, schizophrenia, anxiety and depression and metabolic diseases such as diabetes.

The present invention provides compounds that are MCH1r antagonists which are useful in treating obesity and related disorders, psychiatric disorders, neurological disorders and pain.

5 Description of the invention

The invention relates to compounds of the general formula (I)



10

wherein

R¹ represents a C₁₋₄alkoxy group optionally substituted by one or more fluoro or a C₁₋₄alkyl group optionally substituted by one or more fluoro;

15

n represents 0 or 1;

R² represents a C₁₋₄alkyl group optionally substituted by one or more fluoro or a C₁₋₄alkoxy group optionally substituted by one or more fluoro ;

20

m represents 0 or 1;

R³ represents H or a C₁₋₄alkyl group;

25

L¹ represents an alkylene chain (CH₂)_r in which r represents 2 or 3 or L¹ represents a cyclohexyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclohexyl group either via the 1,3 or the 1,4 positions of the cyclohexyl group or L¹ represents a cyclopentyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclopentyl group via the 1,3 position of the cyclopentyl group and

additionally when R^5 represents 9, 10-methanoanthracen-9(10H)-yl the group $-L^1-N(R^4)-$ together represents a piperidyl ring which is linked to L^2 through the piperidimyl nitrogen and to $N-R^3$ via the 4 position of the piperidyl ring with the proviso that when R^5 represents 9, 10-methanoanthracen-9(10H)-yl then r is only 2;

R^4 represents H or a C_{1-4} alkyl group optionally substituted by one or more of the following: an aryl group or a heteroaryl group;

L^2 represents a bond or an alkylene chain $(CH_2)_s$ in which s represents 1, 2 or 3 wherein the alkylene chain is optionally substituted by one or more of the following: a C_{1-4} alkyl group, phenyl or heteroaryl;

R^5 represents aryl, a heterocyclic group or a C_{3-8} cycloalkyl group which is optionally fused to a phenyl or to a heteroaryl group;

as well as optical isomers and racemates thereof as well as pharmaceutically acceptable salts, thereof;

with a first proviso that when n is 0, and m is 1 and R^2 is methyl located at the 4-position of the quinoline ring, and R^3 is H and R^4 is H and L^1 is $(CH_2)_2$ or $(CH_2)_3$ or 1,4-cyclohexyl, and L^2 is a bond then R^5 is not 4-methylquinolin-2-yl;

and with a second proviso that when n is 0, and m is 0 or 1 and R^2 is a C_{1-3} alkoxy group located at the 4-position of the quinoline ring, and R^3 is H or a C_{1-3} alkyl group and R^4 is H or a C_{1-3} alkyl group and L^1 is $(CH_2)_3$ and L^2 is methylene optionally substituted by one or more C_{1-3} alkyl groups or phenyl then R^5 is not phenyl, thienyl or indolyl optionally substituted by one, two or three C_{1-4} alkyl groups or halo.

The term "aryl" as used herein means phenyl, naphthyl, or 9, 10-methanoanthracen-9(10H)-yl, each of which is optionally substituted by one or more of the following: halo, a C_{1-4} alkyl group, phenyl, or a group of formula NR^6R^7 wherein R^6 and R^7 are independently selected from H or a C_{1-4} alkyl group.

The term "heteroaryl" as used herein means thienyl, furyl or pyrrolyl.

The term "heterocyclic group" as used herein means thienyl, furyl, pyridyl, pyrrolyl, quinolinyl, indolyl, benzofuranyl or benzo[*b*]thienyl each of which is optionally substituted
5 by one or more of the following: halo, a C₁₋₄alkyl group, a C₁₋₄acyl group or nitro. In one group of compounds the term "heterocyclic group" means thienyl, furyl, pyrrolyl, quinolinyl, indolyl or benzo[*b*]thienyl each of which is optionally substituted by one or more of the following: halo, a C₁₋₄alkyl group, a C₁₋₄acyl group or nitro.

10 In one group of compounds of formula (I) : R¹ represents a C₁₋₄alkoxy group; n represents 0 or 1; R² represents a C₁₋₄alkyl group; m represents 0 or 1; R³ represents H or a C₁₋₄alkyl group; L¹ represents an alkylene chain (CH₂)_r in which r represents 2 or 3 with the proviso that r is only 2 when R⁵ represents 9, 10-methanoanthracen-9(10*H*)-yl, or L¹ represents a cyclohexyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to
15 the cyclohexyl group either via the 1,3 or the 1,4 positions of the cyclohexyl group and additionally when R⁵ represents 9, 10-methanoanthracen-9(10*H*)-yl the group -L¹-N(R⁴)- together represents a piperidyl ring which is linked to L² through the piperidinyl nitrogen and to N-R³ via the 4 position of the piperidyl ring; R⁴ represents H or a C₁₋₄alkyl group optionally substituted by one or more of the following: an aryl group or a heteroaryl group;
20 L² represents a bond or an alkylene chain (CH₂)_s in which s represents 1, 2 or 3 wherein the alkylene chain is optionally substituted by one or more of the following: a C₁₋₄alkyl group, phenyl or heteroaryl; R⁵ represents aryl, a heterocyclic group or a C₃₋₈cycloalkyl group which is optionally fused to a phenyl or to a heteroaryl group; as well as optical isomers and racemates thereof as well as pharmaceutically acceptable
25 salts thereof.

Further particular values of R¹, R², R³, R⁴, R⁵, L¹, L², n, m, r and s in compounds of formula I now follow. It will be understood that such values may be used where appropriate with any of the definitions, claims or embodiments defined hereinbefore or
30 hereinafter.

Particularly R^1 represents a C_{1-4} alkoxy group. More particularly R^1 represents methoxy.

Most particularly R^1 represents 6-methoxy when n is 1.

Particularly n represents 1.

- 5 Particularly R^2 represents a C_{1-4} alkyl group. More particularly R^2 represents methyl. Most particularly R^2 represents 4-methyl when m is 1.

Particularly m represents 1.

- Particularly L^1 represents trimethylene, 1,3-cyclopentyl, 1,3-cyclohexyl or 1,4-cyclohexyl
10 or when R^5 represents 9, 10-methanoanthracen-9(10H)-yl L^1 additionally represents ethylene. In one group of compounds of formula I, L^1 represents trimethylene. In a second group of compounds of formula I, L^1 represents 1,3-cyclohexyl. In a third group of compounds of formula I, L^1 represents 1,4-cyclohexyl. In a fourth group of compounds of formula I, L^1 represents 1,3-cyclopentyl.

15

In a particular group of compounds the group $-L^1-N(R^4)-$ together represents a piperidyl ring which is linked to L^2 through the piperidinyl nitrogen and to $N-R^3$ via the 4 position of the piperidyl ring with the proviso that R^5 represents 9, 10-methanoanthracen-9(10H)-yl.

20

Particularly R^3 represents H or a C_{1-4} alkyl group especially methyl. In a particular group of compounds of formula I, R^3 represents H.

- Particularly L^2 represents a bond, methylene, methylenemethylene, dimethylene optionally
25 substituted by phenyl, or trimethylene optionally substituted by methyl. In a particular group of compounds of formula I, L^2 is methylene.

- Particularly R^4 represents H or a C_{1-4} alkyl group optionally substituted by a heteroaryl group. More particularly R^4 represents H, a C_{1-4} alkyl group or thienylmethyl. In a
30 particular group of compounds of formula I, R^4 represents H.

Particularly R⁵ represents phenyl, 2-naphthyl or 9, 10-methanoanthracen-9(10*H*)-yl, each of which is optionally substituted by one or more of the following: methyl, chloro, dimethylamino or phenyl.

- 5 More particularly R⁵ represents 4, 5, 6, 7-tetrahydrothianaphth-4-yl, benzo[*b*]thien-3-yl, 2-thienyl, 3-thienyl, 2-furyl, 3-furyl, benzofuranyl, pyridyl, 1*H*-pyrrol-2-yl, 1*H*-indol-3-yl, or 2-quinolinyl, each of which is optionally substituted by one or more of the following: nitro, methyl, acetyl or chloro.
- 10 Most particularly R⁵ represents cyclopropyl, phenyl, 2, 4, 6-trimethylphenyl, 3, 4-dichlorophenyl, 2-naphthyl, 9, 10-methanoanthracen-9(10*H*)-yl, 2-thienyl, 3-thienyl, 5-nitro-3-thienyl, 2,5-dimethyl-3-thienyl, 3-furanyl, 5-methyl-2-furanyl, 1-acetyl-1*H*-indol-3-yl, 4, 5, 6, 7-tetrahydrothianaphth-4-yl, benzo[*b*]thien-3-yl, 1*H*-indol-3-yl, 2-quinolinyl, 1, 1'-biphenyl-4-yl, 4-(dimethylamino)phenyl, 1*H*-pyrrol-2-yl or 2,5-
- 15 dichloro-3-thienyl.

The term "pharmaceutically acceptable salt", where such salts are possible, includes both pharmaceutically acceptable acid and base addition salts. A suitable pharmaceutically acceptable salt of a compound of Formula I is, for example, an acid-addition salt of a

20 compound of Formula I which is sufficiently basic, for example an acid-addition salt with an inorganic or organic acid such as hydrochloric, hydrobromic, sulphuric, trifluoroacetic, citric or maleic acid; or, for example a salt of a compound of Formula I which is sufficiently acidic, for example an alkali or alkaline earth metal salt such as a sodium, calcium or magnesium salt, or an ammonium salt, or a salt with an organic base such as

25 methylamine, dimethylamine, trimethylamine, piperidine, morpholine or tris-(2-hydroxyethyl)amine.

Throughout the specification and the appended claims, a given chemical formula or name shall encompass all stereo and optical isomers and racemates thereof as well as mixtures in

30 different proportions of the separate enantiomers, where such isomers and enantiomers exist, as well as pharmaceutically acceptable salts thereof. Isomers may be separated using

conventional techniques, e.g. chromatography or fractional crystallisation. The enantiomers may be isolated by separation of racemate for example by fractional crystallisation, resolution or HPLC. The diastereomers may be isolated by separation of isomer mixtures for instance by fractional crystallisation, HPLC or flash chromatography.

5 Alternatively the stereoisomers may be made by chiral synthesis from chiral starting materials under conditions which will not cause racemisation or epimerisation, or by derivatisation, with a chiral reagent. All stereoisomers are included within the scope of the invention.

10 The following definitions shall apply throughout the specification and the appended claims.

Unless otherwise stated or indicated, the term "alkyl" denotes either a straight or branched alkyl group. Examples of said alkyl include methyl, ethyl, n-propyl, isopropyl, n-butyl, 15 iso-butyl, sec-butyl and t-butyl. Preferred alkyl groups are methyl, ethyl, propyl, isopropyl and tertiary butyl.

Unless otherwise stated or indicated, the term "alkoxy" denotes a group O-alkyl, wherein alkyl is as defined above.

20

Unless otherwise stated or indicated, the term "halo" shall mean fluorine, chlorine, bromine or iodine.

The present invention provides a compound selected from:

25 *N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 2-ethanediamine;
N-(6-methoxy-4-methyl-2-quinolinyl)-*N'*-(3-thienylmethyl)-1, 3-propanediamine;
N-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine;
N-(2-quinolinyl)-*N'*-(3-thienylmethyl)-1, 3-propanediamine;
N-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 4-cyclohexanediamine;
30 *N*-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine;

- N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinoliny)-1, 3-cyclohexanediamine;
- N*-(2-quinoliny)-*N'*-[1-(3-thienyl)ethyl]-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-(3-thienylmethyl)-1, 3-cyclohexanediamine;
- 5 *N*-(9,10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(6-methoxy-4-methyl-2-quinoliny)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-(4, 5, 6, 7-tetrahydrothianaphth-4-yl)-1, 3-propanediamine;
- N*-methyl-*N'*-(2-quinoliny)-*N*-(3-thienylmethyl)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*, *N'*-bis(3-thienylmethyl)-1, 3-propanediamine;
- 10 *N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-[(2, 4, 6-trimethylphenyl)methyl]-1, 3-propanediamine;
- N*-(2-phenylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(1-benzo[*b*]thien-3-ylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- 15 *N*-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 3-cyclohexanediamine;
- N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-(2-thienylmethyl)-1, 3-propanediamine;
- N*-(3-furanylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- 20 *N*-[(3, 4-dichlorophenyl)methyl]-*N*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-[1-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-4-piperidiny]-2-quinolinamine;
- N*-(1*H*-indol-3-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(2-naphthalenylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(2, 2-diphenylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- 25 *N*-(1*H*-indol-3-ylmethyl)-*N'*-(6-methoxy-4-methyl-2-quinoliny)-1, 3-propanediamine;
- N*-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 4-cyclohexanediamine;
- N*, *N'*-di-(2-quinoliny)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-(2-quinolinylmethyl)-1, 3-propanediamine;
- 30 *N*-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(cyclopropylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
- N*-(2-quinoliny)-*N'*-(3-thienylmethyl)-1, 4-cyclohexanediamine;

- N*-([1, 1'-biphenyl]-4-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-[3-(5-methyl-2-furanyl)butyl]-1, 3-propanediamine;
N-[[4-(dimethylamino)phenyl]methyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
5 *N*-(1*H*-pyrrol-2-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-[3-(5-methyl-2-furanyl)butyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-[(5-nitro-3-thienyl)methyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-[(5-nitro-3-thienyl)methyl]-1, 3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-(1*H*-pyrrol-2-ylmethyl)-1, 3-propanediamine;
10 *N*-[(3,4-dichlorophenyl)methyl]-*N'*-methyl-*N'*-2-quinoliny)-1, 3-propanediamine;
N-[1-(2,5-dimethyl-3-thienyl)ethyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[1-(2,5-Dichloro-thiophen-3-yl)-ethyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-quinolin-2-ylcyclohexane-1,3-diamine;
N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine;*N*-
15 (6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclopentane-1,3-diamine;
(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclopentane-1,3-diamine
(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine
20 diamine
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine;
N-(1*H*-indol-3-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine;
N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine;
25 *N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclohexane-1,3-diamine;
N-(1-benzofuran-2-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine;
N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(pyridin-2-ylmethyl)cyclohexane-1,3-diamine_and
30 *N*-(4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine;

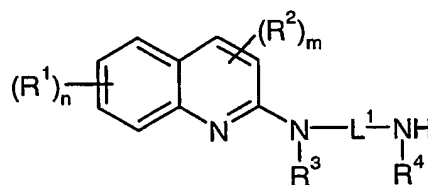
as well as pharmaceutically acceptable salts thereof.

Methods of preparation

5 The compounds of the invention may be prepared as outlined below according to any of the following methods. However, the invention is not limited to these methods, the compounds may also be prepared as described for structurally related compounds in the prior art.

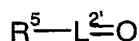
Compounds of formula I may be prepared by reacting a compound of formula II

10



II

in which R¹, R², R³, R⁴, L¹, n and m are as previously defined with a compound of formula III



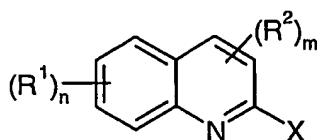
III

15

in which R⁵ is as previously defined and L^{2'} represents a group which after reaction of compounds II and III gives L² on reduction, under reductive alkylation conditions. For example, a compound of formula II and a compound of formula III may be reacted
 20 together at a temperature in the range of 0°C to 250°C, preferably in the range of 50°C to 150°C, optionally in the presence of an inert solvent, for example methanol, dichloromethane or acetic acid in the presence of a reducing agent for example (polystyrylmethyl)trimethyl-ammonium cyanoborohydride or sodium cyanoborohydride which is optionally polymer supported.

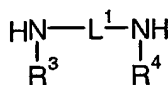
25

Compounds of formula II may be prepared by reacting a compound of formula IV



IV

in which R^1 , R^2 , n and m are as previously defined and X is halo, particularly chloro or bromo, with a compound of formula V



V

at a temperature in the range of 0°C to 250°C , preferably in the range of 50°C to 150°C , optionally in the presence of an inert solvent, for example toluene, optionally in the presence of a catalytic cross-coupling system for example $\text{Pd}(\text{OAc})_2$ and 2-(di-
 10 t -butylphosphino)biphenyl or BINAP, and optionally in the presence of a base for example NaO^tBu .

Certain compounds of formula II are novel and are claimed as a further aspect of the present invention as useful intermediates.

- 15 The compounds of the invention may be isolated from their reaction mixtures using conventional techniques.

Persons skilled in the art will appreciate that, in order to obtain compounds of the invention in an alternative and in some occasions, more convenient manner, the individual process steps mentioned hereinbefore may be performed in a different order, and/or the individual reactions may be performed at a different stage in the overall route (i.e. chemical transformations may be performed upon different intermediates to those associated hereinbefore with a particular reaction). Optionally a nitrogen in formula V may be protected prior to reaction with a compound of formula IV and then the compound of formula II obtained is deprotected prior to reaction with a compound of formula III. Amine protecting groups are known to those skilled in the art for example the t-BOC group.

The expression "inert solvent" refers to a solvent which does not react with the starting materials, reagents, intermediates or products in a manner which adversely affects the yield of the desired product.

Pharmaceutical preparations

The compounds of the invention will normally be administered via the oral, parenteral, intravenous, intramuscular, subcutaneous or in other injectable ways, buccal, rectal, vaginal, transdermal and/or nasal route and/or via inhalation, in the form of pharmaceutical preparations comprising the active ingredient either as a free acid, or a pharmaceutically acceptable organic or inorganic base addition salt, in a pharmaceutically acceptable dosage form. Depending upon the disorder and patient to be treated and the route of administration, the compositions may be administered at varying doses.

Suitable daily doses of the compounds of the invention in the therapeutic treatment of humans are about 0.001-10 mg/kg body weight, preferably 0.01-1 mg/kg body weight.

Oral formulations are preferred particularly tablets or capsules which may be formulated by methods known to those skilled in the art to provide doses of the active compound in the range of 0.5mg to 500mg for example 1 mg, 3 mg, 5 mg, 10 mg, 25mg, 50mg, 100mg and 250mg.

According to a further aspect of the invention there is also provided a pharmaceutical formulation including any of the compounds of the invention, or pharmaceutically acceptable derivatives thereof, in admixture with pharmaceutically acceptable adjuvants, diluents and/or carriers.

The compounds of the invention may also be combined with other therapeutic agents which are useful in the treatment of disorders associated with obesity, psychiatric disorders, neurological disorders and pain.

Pharmacological properties

The compounds of formula (I) are useful for the treatment of obesity, psychiatric disorders such as psychotic disorders, anxiety, anxio-depressive disorders, depression, cognitive disorders, memory disorders, schizophrenia, epilepsy, and related conditions, and neurological disorders such as dementia, multiple sclerosis, Raynaud's syndrome, Parkinson's disease, Huntington's chorea and Alzheimer's disease. The compounds are also potentially useful for the treatment of immune, cardiovascular, reproductive and endocrine disorders, and diseases related to the respiratory and gastrointestinal systems.

The compounds are also potentially useful as agents for ceasing consumption of tobacco, treating nicotine dependence and/or treating nicotine withdrawal symptoms, reducing the craving for nicotine and as anti-smoking agents. The compounds may also eliminate the increase in weight that normally accompanies the cessation of smoking. The compounds are also potentially useful as agents for treating or preventing diarrhoea.

The compounds are also potentially useful as agents for reducing the craving/relapse for addictive substances that include, but are not limited to psychomotor-active agents such as nicotine, alcohol, cocaine, amphetamines, opiates, benzodiazepines and barbiturates. The compounds are also potentially useful as agents for treating drug addiction and/or drug abuse.

Accordingly, it is desirable to provide a compound and method of treatment which will be

active in reducing craving for the abused substance, and which does not exacerbate the sympathetic response rate caused by the abused substance and which has favorable pharmacodynamic effects.

- 5 The compounds are also potentially useful as agents for treating pain disorders , including but not limited to acute and chronic nociceptive, inflammatory and neuropathic pain and migraine.

In another aspect the present invention provides a compound of formula I as claimed in
10 any previous claim for use as a medicament.

In a further aspect the present invention provides the use of a compound of formula I in the preparation of a medicament for the treatment or prophylaxis of obesity, psychiatric disorders such as psychotic disorders, anxiety, anxio-depressive disorders, depression,
15 bipolar disorder, ADHD, cognitive disorders, memory disorders, schizophrenia, epilepsy, and related conditions, neurological disorders such as dementia, multiple sclerosis, Parkinson's disease, Huntington's chorea and Alzheimer's disease and pain related disorders , including but not limited to acute and chronic nociceptive, inflammatory and neuropathic pain and migraine, comprising administering a pharmacologically effective
20 amount of a compound of formula I to a patient in need thereof.

In a still further aspect the present invention provides a method of treating obesity, psychiatric disorders such as psychotic disorders, anxiety, anxio-depressive disorders, depression, bipolar disorder, ADHD, cognitive disorders, memory disorders,
25 schizophrenia, epilepsy, and related conditions, and neurological disorders such as dementia, multiple sclerosis, Parkinson's disease, Huntington's chorea and Alzheimer's disease and pain related disorders, including but not limited to acute and chronic nociceptive, inflammatory and neuropathic pain and migraine, comprising administering a pharmacologically effective amount of a compound of formula I to a patient in need
30 thereof.

The compounds of the present invention are particularly suitable for the treatment of obesity.

Combination Therapy

5 The compounds of the invention may be combined with another therapeutic agent that is useful in the treatment of disorders associated with the development and progress of atherosclerosis such as hypertension, hyperlipidaemias, dyslipidaemias, diabetes and obesity. For example, a compound of the present invention may be used in combination
10 with a compound that affects thermogenesis, lipolysis, fat absorption, satiety, or gut motility. The compounds of the invention may be combined with another therapeutic agent that decreases the ratio of LDL:HDL or an agent that causes a decrease in circulating levels of LDL-cholesterol. In patients with diabetes mellitus the compounds of the invention may also be combined with therapeutic agents used to treat complications related to micro-
15 angiopathies.

The compounds of the invention may be used alongside other therapies for the treatment of metabolic syndrome or type 2 diabetes and its associated complications, these include biguanide drugs, insulin (synthetic insulin analogues) and oral antihyperglycemics (these
20 are divided into prandial glucose regulators and alpha-glucosidase inhibitors).

In another aspect of the invention, the compound of formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, may be administered in association with a PPAR modulating agent. PPAR modulating agents include but are not
25 limited to a PPAR alpha and/or gamma agonist, or pharmaceutically acceptable salts, solvates, solvates of such salts or prodrugs thereof. Suitable PPAR alpha and/or gamma agonists, pharmaceutically acceptable salts, solvates, solvates of such salts or prodrugs thereof are well known in the art.

30 In addition the combination of the invention may be used in conjunction with a sulfonylurea. The present invention also includes a compound of the present invention in combination with a cholesterol-lowering agent. The cholesterol-lowering agents referred to

in this application include but are not limited to inhibitors of HMG-CoA reductase (3-hydroxy-3-methylglutaryl coenzyme A reductase). Suitably the HMG-CoA reductase inhibitor is a statin

- 5 In the present application, the term "cholesterol-lowering agent" also includes chemical modifications of the HMG-CoA reductase inhibitors, such as esters, prodrugs and metabolites, whether active or inactive.

The present invention also includes a compound of the present invention in combination
10 with an inhibitor of the ileal bile acid transport system (IBAT inhibitor). The present invention also includes a compound of the present invention in combination with a bile acid binding resin.

According to an additional further aspect of the present invention there is provided a
15 combination treatment comprising the administration of an effective amount of a compound of the formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, optionally together with a pharmaceutically acceptable diluent or carrier, with the simultaneous, sequential or separate administration one or more of the following agents selected from:

- 20 a CETP (cholesteryl ester transfer protein) inhibitor;
a cholesterol absorption antagonist;
a MTP (microsomal transfer protein) inhibitor ;
a nicotinic acid derivative, including slow release and combination products;
a phytosterol compound ;
25 probucol;
an anti-obesity compound for example orlistat (EP 129,748) and sibutramine (GB 2,184,122 and US 4,929,629);
an antihypertensive compound for example an angiotensin converting enzyme (ACE) inhibitor, an angiotensin II receptor antagonist, an adrenergic blocker, an alpha
30 adrenergic blocker, a beta adrenergic blocker, a mixed alpha/beta adrenergic blocker, an adrenergic stimulant, calcium channel blocker, an AT-1 blocker, a saluretic, a diuretic or a vasodilator;

a CB1 antagonist or inverse agonist ;
another Melanin concentrating hormone (MCH) antagonist;
a PDK inhibitor; or
modulators of nuclear receptors for example LXR, FXR, RXR, and RORalpha;
5 an SSRI;
a serotonin antagonist;
or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof,
optionally together with a pharmaceutically acceptable diluent or carrier to a warm-
blooded animal, such as man in need of such therapeutic treatment.

10

Therefore in an additional feature of the invention, there is provided a method for for the
treatment of type 2 diabetes and its associated complications in a warm-blooded animal,
such as man, in need of such treatment which comprises administering to said animal an
effective amount of a compound of formula I, or a pharmaceutically acceptable salt,
15 solvate, solvate of such a salt or a prodrug thereof in simultaneous, sequential or separate
administration with an effective amount of a compound from one of the other classes of
compounds described in this combination section, or a pharmaceutically acceptable salt,
solvate, solvate of such a salt or a prodrug thereof.

20

Therefore in an additional feature of the invention, there is provided a method of treating
hyperlipidemic conditions in a warm-blooded animal, such as man, in need of such
treatment which comprises administering to said animal an effective amount of a
compound of formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a
salt or a prodrug thereof in simultaneous, sequential or separate administration with an
25 effective amount of a compound from one of the other classes of compounds described in
this combination section or a pharmaceutically acceptable salt, solvate, solvate of such a
salt or a prodrug thereof.

30

According to a further aspect of the invention there is provided a pharmaceutical
composition which comprises a compound of formula I, or a pharmaceutically acceptable
salt, solvate, solvate of such a salt or a prodrug thereof, and a compound from one of the
other classes of compounds described in this combination section or a pharmaceutically

acceptable salt, solvate, solvate of such a salt or a prodrug thereof, in association with a pharmaceutically acceptable diluent or carrier.

According to a further aspect of the present invention there is provided a kit comprising a
5 compound of formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, and a compound from one of the other classes of compounds described in this combination section or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof.

10 According to a further aspect of the present invention there is provided a kit comprising:
a) a compound of formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, in a first unit dosage form;
b) a compound from one of the other classes of compounds described in this combination section or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug
15 thereof; in a second unit dosage form; and
c) container means for containing said first and second dosage forms.

According to a further aspect of the present invention there is provided a kit comprising:
a) a compound of formula I, or a pharmaceutically acceptable salt, solvate, solvate of such
20 a salt or a prodrug thereof, together with a pharmaceutically acceptable diluent or carrier, in a first unit dosage form;
b) a compound from one of the other classes of compounds described in this combination section or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, in a second unit dosage form; and
25 c) container means for containing said first and second dosage forms.

According to another feature of the invention there is provided the use of a compound of the formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, and one of the other compounds described in this combination section, or
30 a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, in the manufacture of a medicament for use in the the treatment of metabolic syndrome or type 2 diabetes and its associated complications in a warm-blooded animal, such as man.

According to another feature of the invention there is provided the use of a compound of the formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, and one of the other compounds described in this combination section, or
5 a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, in the manufacture of a medicament for use in the treatment of hyperlipidaemic conditions in a warm-blooded animal, such as man.

According to a further aspect of the present invention there is provided a combination
10 treatment comprising the administration of an effective amount of a compound of the formula I, or a pharmaceutically acceptable salt, solvate, solvate of such a salt or a prodrug thereof, optionally together with a pharmaceutically acceptable diluent or carrier, with the simultaneous, sequential or separate administration of an effective amount of one of the other compounds described in this combination section, or a pharmaceutically acceptable
15 salt, solvate, solvate of such a salt or a prodrug thereof, optionally together with a pharmaceutically acceptable diluent or carrier to a warm-blooded animal, such as man in need of such therapeutic treatment.

Working examples

20 The invention will now be described in more detail with the following examples that are not to be construed as limiting the invention.

Abbreviations

aq.	aqueous
25 Ac	acetyl
BINAP	<i>rac</i> -2,2'-Bis(diphenyl-phosphino)-1,1'-binaphthyl
Bu	butyl
DMF	<i>N, N'</i> -dimethylformamide
BtOAc	ethyl acetate
30 Et ₂ O	diethyl ether
HEK	human embryonic kidney
HOAc	acetic acid

	HPLC	high performance liquid chromatography
	LC-MS	liquid chromatography mass spectroscopy
	MeOH	methanol
	Pol-BH ₃ CN	(polystyrylmethyl)trimethylammonium cyanoborohydride
5	Pol-CHO	4-benzyloxybenzaldehyde polystyrene
	TFA	trifluoroacetic acid
	THF	tetrahydrofuran
	MeCN	acetonitrile
	NEt ₃	triethylamine
10	Tris	trishydroxymethylaminomethane
	<i>t</i>	tert
	rt.	room temperature
	sat.	saturated
	br	broad
15	bs	broad singlet
	bt	broad triplet
	d	doublet
	dd	doublet of doublets
	m	multiplet
20	q	quartet
	s	singlet
	t	triplet
	tt	triplet of triplets
	td	triplet of doublets
25	bd	broad doublet

General Experimental Procedures

Flash column chromatography employed Matrex normal phase silica gel 60 Å (30-70) µM.

- 30 Mass spectra were recorded on a Micromass ZQ single quadrupole equipped with a pneumatically assisted electrospray interface (LC-MS). Purifications were performed on either a semi preparative HPLC with a mass triggered fraction collector, Shimadzu QP

8000, equipped with a XTerra 100 mm x 19 mm C18 5 μ m column, or on a Waters FractionLynx HPLC with a mass triggered fraction collector, equipped with a Ace μ m 5 5 μ m C8 100 mm x 21.2 mm column or on a Waters Prep LC 2000 with UV-detection, equipped with a Kromasil 10 μ m C8 250 mm x 20 mm column, or on a semi preparative
5 HPLC, Shimadzu LC-8A, Shimadzu SPD-10A UV-vis.-detector equipped with a Waters Symmetry® 100 mm x 19 mm C18 5 μ m column. ^1H NMR and ^{13}C NMR spectra were obtained at 298 K on a Varian Unity Plus 400 MHz, or a Varian INOVA 500 MHz or Bruker Avance 300 MHz. Chemical shifts are given in ppm with the solvent residual peak as internal standard: CDCl_3 δ_{H} 7.26, δ_{C} 77.2; $\text{MeOH-}d_4$ δ_{H} 3.31, δ_{C} 49.0; $\text{DMSO-}d_6$ δ_{H}
10 2.50; δ_{C} 39.5 ppm, $\text{DMF-}d_7$ δ_{H} 2.75/2.95/8.05, acetone- d_6 δ_{H} 2.05, $\text{THF-}d_8$ δ_{H} 1.74/3.60 ppm. Microwave heating was performed using single node heating in a Smith Creator from Personal Chemistry, Uppsala, Sweden.

Synthesis of Starting Materials and Intermediates

A1 N-Quinolin-2-ylpropane-1,3-diamine

A mixture of 2-chloroquinoline (4.80 mmol, 1.0 g), 1, 3-propanediamine (7.20 mmol, 0.534 g), NaO^tBu (6.72 mmol, 0.646 g), $\text{Pd}(\text{OAc})_2$ (0.048 mmol, 0.011 g), and 2-(di-
 t butylphosphino)biphenyl (0.048 mmol, 0.014 g) in toluene (12 mL) was stirred at 100 °C
under nitrogen until LC-MS indicated that starting material was consumed. The reaction
20 mixture was cooled to room temperature, poured into Et_2O (100 mL) and filtered through a plug of filtration aid. The filtrate was concentrated and the residue purified on a pre-packed SiO_2 column (70 g) eluted with CH_2Cl_2 (containing 0.5% HOAc, 300 mL), CH_2Cl_2 :MeOH (5:1, 300 mL), and finally with CH_2Cl_2 :MeOH: H_2O (10:6:1, containing 1% Et_3N) to give 0.915 g (95%) of the title compound. ^1H NMR (400 MHz, $\text{MeOH-}d_4$) δ 7.85 (d, J = 10.1
25 Hz, 1H), 7.62 - 7.58 (m, 2H), 7.51 (t, J = 8.5 Hz, 1H), 7.20 (t, J = 8.0 Hz, 2H), 6.76 (d, J = 8.8 Hz, 1H), 3.61 (t, J = 6.5 Hz, 2H), 2.92 (t, J = 6.6 Hz, 2H), 1.93 (quintet, J = 6.8 Hz, 2H).

A2 N-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine

30 The title compound was prepared from 2-chloro-6-methoxy-4-methylquinoline and 1, 3-propanediamine using the procedure described for preparation A1. Yield quantitative. ^1H

NMR (400 MHz, DMSO- d_6) δ 7.42 (d, J = 9.1 Hz, 1H), 7.12 - 7.078 (m, 2H), 6.57 (s, 1H), 3.80 (s, 3H), 3.37 (t, J = 6.6 Hz, 2H), 2.66 (bt, J = 6.6 Hz, 2H), 2.43 (s, 3H), 1.67 (quintet, J = 6.8 Hz, 2H).

5 **A3 *N*-Quinolin-2-ylcyclohexane-1, 4-diamine**

The title compound was prepared as a mixture of isomers from 2-chloroquinoline and cyclohexane-1, 4-diamine using the procedure described for preparation A1. Yield 94%.

^1H NMR (400 MHz, MeOH- d_4 , major isomer) δ 7.92 (d, J = 9.1 Hz, 1H), 7.63 (d, J = 8.3 Hz, 1H), 7.60 (d, J = 8.1 Hz, 1H), 7.54 - 7.50 (m, 1H), 7.22 (t, J = 8.0 Hz, 1H), 6.92 (d, J = 9.3 Hz, 1H), 4.17 - 4.09 (m, 1H), 3.29 - 3.21 (m, 1H), 2.22 - 2.08 (m, 1H), 1.94 - 1.75 (m, 6H), 1.69 - 1.37 (m, 1H).

A4 *N*-Quinolin-2-ylcyclohexane-1, 3-diamine

The title compound was prepared as a mixture of diastereomers from 2-chloroquinoline and cyclohexane-1, 3 -diamine using the procedure described for preparation A1. Yield 84%. ^1H NMR (400 MHz, MeOH- d_4 , major isomer) δ 7.82 (d, J = 8.9 Hz, 1H), 7.61 - 7.57 (m, 2H), 7.48 (t, J = 8.5 Hz, 1H), 7.19 (d, J = 7.9 Hz, 1H), 6.73 (d, J = 9.1 Hz, 1H), 4.12 - 4.04 (m, 1H), 3.28 - 3.21 (m, 2H), 2.56 - 2.50 (m, 1H), 2.07 (t, J = 12.0 Hz, 1H), 1.98 - 1.93 (m, 1H), 1.82 - 1.75 (m, 1H), 1.62 - 1.49 (m, 1H), 1.41 - 1.23 (m, 2H).

20 **A5 *N*-Quinolin-2-ylethane-1, 2-diamine**

The title compound was prepared from 2-chloroquinoline and 1, 2-ethanediamine using the procedure described for preparation of A1. Yield 65%. ^1H NMR (400 MHz, MeOH- d_4) δ 7.81 (d, J = 9.1 Hz, 1H), 7.61 - 7.56 (m, 2H), 7.47 (t, J = 8.5 Hz, 1H), 7.16 (t, J = 8.1 Hz, 1H), 6.74 (d, J = 8.9 Hz, 1H), 3.55 (t, J = 6.2 Hz, 2H), 2.91 (t, J = 6.1 Hz, 2H).

A6 *N*-Methyl-*N'*-quinolin-2-ylpropane-1, 3-diamine

The title compound was prepared from 2-chloroquinoline and *N'*-methyl-1, 3-propanediamine using the procedure described for preparation A1. Yield 61%. ^1H NMR (400 MHz, MeOH- d_4) δ 7.87 (d, J = 9.06 Hz, 1H), 7.64 - 7.59 (m, 2H), 7.56 - 7.50 (m, 1H), 7.22 (t, J = 7.4 Hz, 1H), 6.78 (d, J = 8.9 Hz, 1H), 3.63 (t, J = 6.3 Hz, 2H), 3.03 (t, J = 6.5 Hz, 2H), 2.65 (s, 3H), 2.02 (m, 2H).

A7 N-Methyl-N-quinolin-2-ylpropane-1, 3-diamine

The title compound was isolated from preparation A6. ¹H NMR (400 MHz, MeOH-*d*₄) δ
8.03 (d, *J* = 9.1 Hz, 1H), 7.69 – 7.59 (m, 2H), 7.58 – 7.52 (m, 1H), 7.22 (t, *J* = 7.4 Hz, 1H),
5 7.08 (d, *J* = 9.1 Hz, 1H), 3.88 (t, *J* = 6.2 Hz, 2H), 3.16 (s, 3H), 2.94 (t, *J* = 6.4 Hz, 2H),
2.02 (m, 2H).

A8 N-Piperidin-4-ylquinolin-2-amine

The title compound was prepared from 2-chloroquinoline and piperidin-4-ylamine using
10 the procedure described for preparation A1. Yield 18%. ¹H NMR (400 MHz, MeOH-*d*₄) δ
7.77 (d, *J* = 9.1 Hz, 1H), 7.59 (d, *J* = 8.3 Hz, 1H), 7.54 (d, *J* = 8.3 Hz, 1H), 7.46 (t, *J* = 8.5
Hz, 1H), 7.21 - 7.07 (m, 1H), 6.71 (d, *J* = 9.8 Hz, 1H), 4.13 - 4.06 (m, 1H), 3.13 (d, *J* =
12.5 Hz, 2H), 2.80 (dt, *J* = 3.1, 13.7 Hz, 2H), 2.10 - 2.06 (m, 2H), 1.56 - 1.46 (m, 2H).

A9 9-Formyl-9,10-dihydro-9,10-methanoanthracene

Prepared according to literature preparation: H. Sunagawa, et al; Chem. Pharm. Bull. Vol.
27 (1979) pp 1806-1812; U.S. Pat. No. 4,224,344 Sunagawa et al, Sumitomo, Ltd.; Sep.
23, 1980; U.S. Pat. No. 4,358,620 Sunagawa et al, Sumitomo, Ltd.; Nov. 9, 1982.

A10 (1*R*,3*S*)-3-[(*tert*-butoxycarbonyl)amino]cyclopentyl methanesulfonate

Prepared according to literature preparation from (–)-2-azabicyclo[2.2.1]hept-5-en-3-one
(>95% ee): H. Bergstrand, et al; Astra AB; New Pharmaceutically Active Compounds;
WO9811103; Mars 19, 1998.

A11 *tert*-butyl [(1*S*,3*S*)-3-azidocyclopentyl]carbamate

NaN₃ (16.6 g, 0.25 mmol) was added to a stirred solution of (1*R*,3*S*)-3-[(*tert*-
butoxycarbonyl)amino]cyclopentyl methanesulfonate (20 g, crude, ~0.05 mol) in DMF
(250 mL) under nitrogen atmosphere. The mixture was heated to 50 °C for 18 h (over
night). The mixture was allowed to reach rt. and poured into H₂O (200 mL) and extracted
30 with EtOAc (2 × 400 mL), 200 mL Et₂O and concentrated. Purification of the residue by
flash chromatography [280 g silica gel, 6 × 22 cm column, with EtOAc/heptane (2:3 →
1:1) as eluent] afforded the title compound (16.5 g, contaminated with DMF) as a slightly

yellowish oil taken to the next step without further purification. ^1H NMR (CDCl_3) δ 4.52 (bs, 1H), 4.00–4.10 (m, 2H), 1.98–2.22 (m, 3H), 1.62–1.78 (m, 2H), 1.42–1.52 (m, 1H), 1.44 (s, 9 H).

5 **A12 tert-butyl [(1S,3S)-3-aminocyclopentyl]carbamate**

A flask containing *tert*-butyl [(1S,3S)-3-aminocyclopentyl]carbamate (16.5 g, crude ~0.05 mol) from A11 and 1.7 g Pd-C (10% paste) in MeOH (300 mL) was exposed to a positive pressure of hydrogen gas (balloon) over weekend. The catalyst was filtrated off and the mixture was concentrated to afford the title compound (9.5 g) as a thick colorless viscous
10 oil. ^1H NMR ($\text{DMSO}-d_6$) δ 6.74 (bd, 1H), 3.86–3.92 (m, 1H), 3.28 (quintet, 1H), 1.73–1.98 (m, 2H), 1.43–1.59 (m, 2H), 1.22–1.41 (m, 1H), 1.36 (s, 9 H), 1.07–1.20 (m, 1H). ^{13}C NMR ($\text{DMSO}-d_6$) δ 155.0, 77.2, 50.8, 50.0, 42.6, 34.2, 31.2, 28.3. LC-MS $[\text{M}+\text{H}]^+$ 201

A13 N-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine

15 A mixture of 2-chloro-6-methoxy-4-methylquinoline (1.20 mmol, 0.250 g), 1,3-cyclohexanediamine (3.61 mmol, 0.412 g), NaO^tBu (1.70 mmol, 0.162 g), $\text{Pd}(\text{OAc})_2$ (0.02 mmol, 0.004 g), and 2-(di- t butylphosphino)biphenyl (0.034 mmol, 0.010 g) in toluene (5 mL) was stirred at 100 °C under argon for 24 h. The reaction mixture was cooled to room temperature, diluted with EtOAc/MeOH 5:1 containing 1% NEt_3 and loaded directly on a
20 short (~2cm) silica column. Elution with EtOAc/MeOH 5:1 containing 1% NEt_3 gave 0.241 g (70%) of the title compound as a mixture of diastereomers (~6:1). ^1H NMR (400 MHz, $\text{MeOH}-d_4$) δ 7.52 (d, $J = 9.1$ Hz, 1H, major isomer), 7.52 (d, $J = 9.1$ Hz, 1H, minor isomer), 7.12 (dd, $J = 9.1, 2.8$ Hz, 1H), 7.05 (d, $J = 2.8$ Hz, 1H), 6.62 (bs, 1H, minor isomer), 6.53 (bs, 1H, major isomer), 4.27 (m, 1H, minor isomer), 3.88 (tt, $J = 11.6, 3.8$
25 Hz, 1H, major isomer), 3.80 (s, 3H), 3.02 (m, 1H, minor isomer), 2.76 (tt, $J = 11.4, 3.8$ Hz, 1H, major isomer), 2.44 (bs, 3H, minor isomer), 2.42 (bs, 3H, major isomer), 2.21 (m, 1H), 2.02–0.96 (m, 7H); ^{13}C NMR (101 MHz, $\text{MeOH}-d_4$, major isomer) δ 156.8, 155.9, 145.3, 144.1, 127.5, 125.1, 120.8, 114.2, 104.8, 55.9, 50.5, 49.6, 43.5, 35.8, 33.6, 24.3, 18.9; LC-MS $[\text{M}+\text{H}]^+$ 286.1.

A14 *N*-(4-methylquinolin-2-yl)cyclohexane-1,3-diamine

A solution of 2-chloro-4-methylquinoline (0.200 g, 1.13 mmol) and 1,3-diaminocyclohexane (0.51 g, 4.5 mmol) in 3 mL of pyridine was subjected to single node microwave heating (210°C for 1h). The reaction mixture was cooled to room temperature and evaporated. The crude product was flash chromatographed on silica gel and eluted with EtOAc/MeOH/Et₃N 50:50:1 to give 0.24 g (84%) of the title compound as a mixture of diastereomers (~2.7:1).

¹H NMR (300 MHz, MeOH-*d*₄) δ 7.7-7.8 (m, 1H), 7.58-7.63 (m, 1H), 7.45-7.55 (m, 1H), 7.18-7.25 (m, 1H), 6.70 (bs, 1H, minor isomer) 6.61 (bs, 1H, major isomer), 4.44 (m, 1H, minor isomer), 4.06 (m, 1H, major isomer), 2.48-2.55 (m, 3H plus 1H, major isomer), 2.32 (m, 1H, minor isomer), 1.2-2.1 (m, 8H).

Examples**Example 1*****N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(quinolin-2-yl)-1, 2-ethanediamine**

Pol-BH₃CN (150 mg, pre-swollen in CH₂Cl₂) was added to a solution of *N*-quinolin-2-ylethane-1, 2-diamine (0.299 mmol, 0.056 g) and 9-formyl-9,10-dihydro-9,10-methanoanthracene (0.225 mmol, 0.050 g) in MeOH:CH₂Cl₂ (1:1, containing 1% HOAc, 2.5 mL), and the resultant slurry was subjected to microwave heating single node 100 °C, 5 min. The resin was filtered off and washed with portions (1-2 mL) of CH₂Cl₂ and MeOH, and the filtrate was concentrated. The residue was dissolved in CH₂Cl₂ (5 mL), and Pol-CHO (140 mg) was added, and the slurry was stirred at room temperature for 60 min. The resin was filtered off and washed with portions (1-2 mL each) of CH₂Cl₂. The filtrate was concentrated, and the residue was purified on SiO₂ (EtOAc:MeOH 9:1) to give 0.078 g (88%) of the title compound. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.85 (d, *J* = 8.9 Hz, 1H), 7.56 (dd, *J* = 1.2, 9.0 Hz, 1H), 7.39 (dt, *J* = 1.4, 11.5 Hz, 1H), 7.22 (d, *J* = 7.3 Hz, 2H), 7.14 (dt, *J* = 1.2, 7.9 Hz, 1H), 7.12 - 7.06 (m, 3H), 6.86 (dt, *J* = 1.2, 7.5 Hz, 2H), 6.82 - 6.75 (m, 3H), 4.30 (s, 1H), 4.02 (s, 2H), 3.80 (t, *J* = 5.2 Hz, 2H), 3.39 (t, *J* = 5.6 Hz, 2H), 2.55 (s, 2H).

Examples 2 to 45 were performed using the procedure described in Example 1 by reacting an amine with an aldehyde as stated.

Example 2

***N*-(6-Methoxy-4-methyl-2-quinolinyl)-*N'*-(3-thienylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and 3-thiophenecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 34% yield. ¹H NMR (400 MHz, DMF-*d*₇) δ 7.48 - 7.46 (m, 1H), 7.45 (d, *J* = 9.1 Hz, 1H), 7.32 - 7.31 (m, 1H), 7.17 (dd, *J* = 2.6, 13.5 Hz, 2H), 7.13 (t, *J* = 4.2 Hz, 1H), 6.67 (s, 1H), 3.88 (s, 3H), 3.77 (s, 2H), 3.53 (t, *J* = 6.6 Hz, 2H), 2.69 (t, *J* = 6.7 Hz, 2H), 2.49 (s, 3H), 1.82 (quintet, *J* = 6.7 Hz, 2H).

Example 3

***N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified on SiO₂ (CH₂Cl₂:MeOH 20:1 → 10:1, containing 1% HOAc) to give the title compound in 50% yield. ¹H NMR (MeOH-*d*₄, 400 MHz) δ 7.85 (d, *J* = 8.9 Hz, 1H), 7.57 (dd, *J* = 1.4, 9.3 Hz, 1H), 7.36 - 7.32 (m, 5H), 7.31 - 7.22 (m, 5H), 7.14 (t, *J* = 8.0 Hz, 1H), 7.01 - 6.93 (m, 5H), 6.75 (d, *J* = 9.1 Hz, 1H), 4.43 (s, 1H), 4.21 (s, 2H), 3.70 (t, *J* = 6.4 Hz, 2H), 3.31 (t, *J* = 1.4 Hz, 2H), 2.65 (s, 2H), 2.23 (quintet, *J* = 6.5 Hz, 2H).

Example 4

***N*-(2-Quinolinyl)-*N'*-(3-thienylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-thiophenecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 74% yield. ¹H

NMR (400 MHz, MeOH- d_4) δ 7.86 (d, J = 8.4 Hz, 1H), 7.61 (d, J = 8.0 Hz, 1H), 7.50 - 7.48 (m, 2H), 7.43 (t, J = 8.5 Hz, 1H), 7.27 (d, J = 8.9 Hz, 1H), 7.20 (t, J = 7.7 Hz, 1H), 7.15 - 7.13 (m, 1H), 6.75 (d, J = 9.5 Hz, 1H), 4.23 (s, 2H), 3.65 (t, J = 6.2 Hz, 2H), 3.06 (t, J = 7.1 Hz, 2H), 2.05 (quintet, J = 6.4 Hz, 2H).

5

Example 5

***N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 4-cyclohexanediamine**

10 This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 4-diamine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN \rightarrow 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a diastereomeric mixture in 25% yield. ¹H NMR (400 MHz, MeOH- d_4 , major isomer) δ 7.78 (d, J = 9.1 Hz, 1H), 7.59 (d, J = 8.5 Hz, 1H), 7.55 (d, J = 9.1 Hz, 1H),
15 7.46 (t, J = 8.5 Hz, 1H), 7.24 (d, J = 7.7 Hz, 2H), 7.16 - 7.12 (m, 3H), 6.97 - 6.89 (m, 4H), 6.79 (d, J = 8.9 Hz, 1H), 4.27 (s, 1H), 4.23 - 4.19 (m, 1H), 3.67 (s, 2H), 2.90 - 2.85 (m, 1H), 2.51 (d, J = 1.4 Hz, 2H), 1.94 - 1.85 (m, 4H), 1.82 - 1.67 (m, 4H).

Example 6

20

***N*-[(1-Acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and 1-acetyl-3-indolecarboxaldehyde, and purified on SiO₂
25 (CH₂Cl₂:MeOH 40:1 \rightarrow 2:1) to give the title compound in 36% yield. ¹H NMR (400 MHz, MeOH- d_4 , major rotamer) δ 8.33 (d, J = 7.5 Hz, 1H), 7.59 (d, J = 7.5 Hz, 1H), 7.55 (s, 1H), 7.31 (d, J = 7.3 Hz, 1H), 7.26 - 7.21 (m, 2H), 7.10 (d, J = 2.8 Hz, 1H), 6.98 (dd, J = 2.8, 11.9 Hz, 1H), 6.54 (s, 1H), 4.08 (s, 2H), 3.84 (s, 3H), 3.57 (t, J = 6.3 Hz, 2H), 2.97 (t, J = 6.6 Hz, 2H), 2.49 (s, 3H), 2.47 (d, J = 0.8 Hz, 3H), 2.01 - 1.94 (m, 2H).

30

Example 7***N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinolinyl)-1, 3-cyclohexanediamine**

5 This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 3-diamine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a mixture of diastereomers in 60% yield. ¹H NMR (400 MHz, MeOH-*d*₄, major isomer) δ 7.75 (d, *J* = 8.8 Hz, 1H), 7.62 (d, *J* = 8.5 Hz, 1H), 7.53 (d, *J* = 8.6, 1H),
10 7.46 (dt, 1.2, 7.4 Hz, 1H), 7.23 - 7.08 (m, 5H), 6.95 - 6.84 (m, 4H), 6.68 (d, *J* = 9.0 Hz, 1H), 4.23 (s, 1H), 4.15 - 4.05 (m, 1H), 3.65 (d, *J* = 2.6 Hz, 2H), 2.92 - 2.81 (m, 1H), 2.53 - 2.39 (m, 3H), 2.13 - 2.01 (m, 2H), 1.91 - 1.81 (m, 2H), 1.60 - 1.46 (m, 1H), 1.29 - 1.12 (m, 2H).

15 **Example 8**

***N*-(2-Quinolinyl)-*N'*-[1-(3-thienyl)ethyl]-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-acetylthiophene, but subjected to microwave heating single node 140 °C, 5 min., and
20 purified on SiO₂ (CH₂Cl₂:MeOH 1:0 → 0:1) to give the title compound in 30% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.80 (d, *J* = 9.1 Hz, 1H), 7.58 (d, *J* = 7.9 Hz, 1H), 7.48 - 7.37 (m, 4H), 7.18 (t, *J* = 7.4 Hz, 1H), 7.06 (d, *J* = 5.0 Hz, 1H), 6.70 (d, *J* = 8.9 Hz, 1H), 4.42 - 4.38 (m, 1H), 3.59 - 3.55 (m, 2H), 2.91 - 2.79 (m, 2H), 2.02 - 1.93 (m, 2H), 1.56 (d, *J* = 6.7 Hz, 3H).

25

Example 9***N*-(2-Quinolinyl)-*N'*-(3-thienylmethyl)-1, 3-cyclohexanediamine**

This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 3-diamine and 3-thiophenecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate
30 buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a mixture of diastereomers in 33% yield. ¹H NMR (400 MHz, MeOH-*d*₄, major isomer) δ

7.81 (d, $J = 8.9$ Hz, 1H), 7.58 (t, $J = 9.1$ Hz, 2H), 7.50 - 7.46 (m, 3H), 7.20 - 7.15 (m, 2H), 6.71 (d, $J = 8.9$ Hz, 1H), 4.12 (s, 2H), 4.09 - 4.00 (m, 1H), 3.12 - 3.04 (m, 1H), 2.59 (d, $J = 11.9$ Hz, 1H), 2.15 (d, $J = 12.7$ Hz, 1H), 2.08 (d, $J = 14.0$ Hz, 1H), 1.98 - 1.93 (m, 1H), 1.79 (s, 1H), 1.57 - 1.45 (m, 1H), 1.37 - 1.21 (m, 2H).

5

Example 10

***N*-(9,10-Methanoanthracen-9(10*H*)-ylmethyl)-*N*'-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine**

10

This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified using HPLC (95% 0.1 M ammoniumacetatebuffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 20% yield. ¹H NMR (400 MHz, DMF-*d*₇) δ 7.36 - 7.31 (m, 5H), 7.20 (d, $J = 2.8$ Hz, 1H), 7.11 (dd, $J = 11.9, 2.8$ Hz, 1H), 6.97 (d, $J = 3.0$ Hz, 2H), 6.95 (d, $J = 3.2$ Hz, 2H), 6.65 (s, 1H), 4.40 (s, 1H), 4.01 (s, 2H), 3.88 (s, 3H), 3.62 (t, $J = 6.5$ Hz, 2H), 3.25 - 3.21 (m, 2H), 2.61 (s, 2H), 2.49 (s, 3H), 2.14 - 2.08 (m, 2H).

15

Example 11

20

***N*-(2-Quinolinyl)-*N*'-(4, 5, 6, 7-tetrahydrothianaphth-4-yl)-1, 3-propanediamine (alternative name *N*-quinolin-2-yl-*N*'-(4,5,6,7-tetrahydro-1-benzothien-4-yl)propane-1,3-diamine)**

25

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 4-keto-4, 5, 6, 7-tetrahydrothianaphthene, but subjected to microwave heating single node 120 °C, 15 min., and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in 34% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.82 (d, $J = 9.3$ Hz, 1H), 7.57 (d, $J = 8.5$ Hz, 1H), 7.38 (t, $J = 8.3$ Hz, 1H), 7.22 (d, $J = 5.7$ Hz, 1H), 7.18 - 7.12 (m, 3H), 6.73 (d, $J = 8.4$ Hz, 1H), 4.19 (t, $J = 5.9$ Hz, 1H), 3.76 - 3.69 (m, 1H), 3.56 - 3.50 (m, 1H), 3.00 (t, $J = 7.2$ Hz,

30

2H), 2.71 - 2.64 (m, 1H), 2.54 - 2.47 (m, 1H), 2.09 - 1.94 (m, 3H), 1.87 - 1.78 (m, 1H), 1.75 - 1.65 (m, 1H), 1.64 - 1.56 (m, 1H).

Example 12

***N*-Methyl-*N'*-(2-quinolinyl)-*N*-(3-thienylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-methyl-*N'*-quinolin-2-ylpropane-1, 3-diamine and 3-thiophenecarboxaldehyde, and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in 24% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.80 (d, *J* = 8.8 Hz, 1H), 7.59 - 7.55 (m, 2H), 7.46 (dt, *J* = 1.4, 8.0 Hz, 1H), 7.31 (dd, *J* = 2.8, 7.8 Hz, 1H), 7.22 (bs, 1H), 7.16 (dt, *J* = 1.2, 7.4 Hz, 1H), 7.06 (dd, *J* = 1.2, 8, 4.7 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 3.62 (s, 2H), 3.48 (t, *J* = 6.8 Hz, 2H), 2.54 (t, *J* = 7.3 Hz, 2H), 2.25 (s, 3H), 1.90 (quintet, *J* = 7.0 Hz, 2H).

Example 13

***N*-(2-Quinolinyl)-*N'*, *N'*-bis(3-thienylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-thiophenecarboxaldehyde, but subjected to microwave heating single node 110 °C, 5 min., and purified on SiO₂ (CH₃Cl:MeOH 10:1 → 2:1) to give the title compound in 30% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.82 (d, *J* = 8.8 Hz, 1H), 7.60 (t, *J* = 7.5 Hz, 2H), 7.49 (t, *J* = 8.9 Hz, 1H), 7.32 (m, 1H), 7.23 (bs, 2H), 7.19 (m, 2H), 7.10 (d, *J* = 4.2 Hz, 2H), 6.65 (d, *J* = 9.1 Hz, 1H), 3.65 (s, 4H), 3.49 (t, *J* = 6.6 Hz, 2H), 2.59 (t, *J* = 6.6 Hz, 2H), 1.91 (quintet, *J* = 7.0 Hz, 2H).

Example 14***N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N*-methyl-*N*'-(2-quinolinyl)-1, 3-propanediamine**

- 5 This compound was prepared from *N*-methyl-*N*'-quinolin-2-ylpropane-1, 3-diamine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in 11% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.71 (d, *J* = 8.8 Hz, 1H), 7.56 (t, *J* = 8.2 Hz, 2H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.19 - 7.14 (m, 5H), 6.89 - 6.83 (m, 4H), 6.40 (d, *J* = 8.8 Hz, 1H), 4.20 (s, 1H), 3.51 - 3.48 (m, 4H), 2.76
10 (t, *J* = 6.9 Hz, 2H), 2.56 (s, 2H), 2.43 (s, 3H), 1.96 - 1.89 (m, 2H).

Example 15***N*-(2-Quinolinyl)-*N*'-[(2, 4, 6-trimethylphenyl)methyl]-1, 3-propanediamine**

- 15 This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 2, 4, 6-trimethyl-benzaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 27% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.87 (d, *J* = 9.0 Hz, 1H), 7.59 (dd, *J* = 9.3, 1.6 Hz, 1H), 7.27 - 7.23 (m, 1H), 7.18 - 7.14 (m, 1H), 6.96 (s, 2H), 6.90 (d, *J* = 8.4 Hz,
20 1H), 6.78 (d, *J* = 8.9 Hz, 1H), 4.30 (s, 2H), 3.71 (t, *J* = 6.2 Hz, 2H), 3.21 (t, *J* = 6.7 Hz, 2H), 2.39 (s, 6H), 2.31 (s, 3H), 2.16 (quintet, *J* = 6.5 Hz, 2H).

Example 16***N*-(2-Phenylethyl)-*N*'-(2-quinolinyl)-1, 3-propanediamine**

- 25 This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and phenyl acetaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 4% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.88 (d, *J* = 9.0 Hz, 1H), 7.65 - 7.52 (m, 3H), 7.30 - 7.19 (m, 4H),
30 7.15 (d, *J* = 1.7 Hz, 1H), 7.13 (s, 1H), 6.77 (d, *J* = 9.1 Hz, 1H), 3.65 (t, *J* = 6.3 Hz, 2H), 3.22 - 3.18 (m, 2H), 3.11 (t, *J* = 6.8 Hz, 2H), 2.95 - 2.91 (m, 2H), 2.04 (quintet, *J* = 6.5 Hz, 2H).

Example 17***N*-(1-Benzo[*b*]thien-3-ylethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-acetylthianaphthene but subjected to microwave heating single node 120 °C, 2 x 5 min., and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in 30% yield.

¹H NMR (400 MHz, MeOH-*d*₄) δ 7.88 - 7.80 (m, 2H), 7.77 (d, *J* = 8.9 Hz, 1H), 7.58 (s, 1H), 7.55 (dd, *J* = 1.4, 9.1 Hz, 1H), 7.37 - 7.27 (m, 4H), 7.14 (t, *J* = 8.0 Hz, 1H), 6.66 (d, *J* = 9.2 Hz, 1H), 4.70 (q, *J* = 6.9 Hz, 1H), 3.64 - 3.52 (m, 2H), 3.03 - 2.97 (m, 1H), 2.91 - 2.85 (m, 1H), 1.98 (octet, *J* = 6.7 Hz, 2H), 1.65 (d, *J* = 6.6 Hz, 3H).

Example 18

15

***N*-[(3, 4-Dichlorophenyl)methyl]-*N'*-(2-quinolinyl)-1, 3-cyclohexanediamine**

This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 4-diamine and 3, 4-dichlorobenzaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a

diastereomeric mixture in 66% yield. ¹H NMR (400 MHz, MeOH-*d*₄, major isomer) δ 7.79 (d, *J* = 8.9 Hz, 1H), 7.60 - 7.53 (m, 3H), 7.50 - 7.45 (m, 2H), 7.31 (dd, *J* = 2.0, 10.1 Hz, 1H), 7.18 - 7.14 (m, 1H), 6.70 (d, *J* = 9.2 Hz, 1H), 4.04 - 3.96 (m, 1H), 3.89 (s, 2H), 2.88 - 2.81 (m, 1H), 2.47 (d, *J* = 12.1 Hz, 1H), 2.06 (d, *J* = 12.1 Hz, 2H), 1.92 - 1.86 (m, 1H), 1.80 - 1.67 (m, 1H), 1.54 - 1.42 (m, 1H), 1.29 - 1.12 (m, 2H).

25

Example 19***N*-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-*N'*-methyl-*N'*-(2-quinolinyl)-1, 3-propanediamine.**

The title compound was isolated from synthesis of Example 14. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.90 (d, *J* = 9.0 Hz, 1H), 7.56 (d, *J* = 8.3 Hz, 1H), 7.35 (t, *J* = 8.2 Hz, 1H), 7.27 - 7.23 (m, 3H), 7.15 - 7.10 (m, 3H), 7.02 (d, *J* = 8.8 Hz, 1H), 6.94 - 6.86 (m, 4H), 4.26

(s, 1H), 3.87 (t, $J = 6.9$ Hz, 2H), 3.63 (s, 2H), 3.18 (s, 3H), 2.85 (t, $J = 6.6$ Hz, 2H), 2.49 (s, 2H), 2.01 (quintet, $J = 7.0$ Hz, 2H).

Example 20

***N*-(2-Quinoliny)-*N'*-(2-thienylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 2-thiophenecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in

18% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.84 (d, $J = 8.9$ Hz, 1H), 7.60 (dd, $J = 1.7$, 9.3 Hz, 1H), 7.47 - 7.42 (m, 3H), 7.37 (d, $J = 8.4$ Hz, 2H), 7.20 - 7.17 (m, 1H), 7.10 (d, $J = 3.2$ Hz, 1H), 7.00 (dd, $J = 3.7$, 8.4 Hz, 1H), 6.74 (d, $J = 9.4$ Hz, 1H), 4.28 (s, 2H), 3.61 (t, $J = 6.5$ Hz, 2H), 2.96 (t, $J = 7.1$ Hz, 2H), 2.00 (quintet, $J = 6.8$ Hz, 2H).

Example 21

***N*-(3-Furanylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-furaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN

→ 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 21% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.86 (d, $J = 8.4$ Hz, 1H), 7.61 (d, $J = 9.5$ Hz, 1H), 7.54 (d, $J = 6.8$ Hz, 2H), 7.50 - 7.41 (m, 2H), 7.21 (t, $J = 8.1$ Hz, 1H), 6.75 (d, $J = 9.1$ Hz, 1H), 6.46 (t, $J = 0.9$ Hz, 1H), 4.04 (s, 2H), 3.64 (t, $J = 6.4$ Hz, 2H), 3.02 (t, $J = 6.7$ Hz, 2H), 2.03 (quintet, $J = 6.6$ Hz, 2H).

Example 22

***N*-[(3, 4-Dichlorophenyl)methyl]-*N*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine**

This compound was prepared from *N*-methyl-*N'*-quinolin-2-ylpropane-1, 3-diamine and 3, 4-dichlorobenzaldehyde, and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the

title compound in 20% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.79 (d, $J = 9.3$ Hz, 1H), 7.60 - 7.55 (m, 2H), 7.49 - 7.44 (m, 2H), 7.33 (d, $J = 9.3$ Hz, 1H), 7.22 - 7.13 (m, 2H), 6.68

(d, $J = 8.8$ Hz, 1H), 3.49 (t, $J = 7.4$ Hz, 2H), 3.49 (s, 2H), 2.52 (t, $J = 7.4$ Hz, 2H), 2.22 (s, 3H), 1.87 (quintet, $J = 7.2$ Hz, 2H).

5 **Example 23**

***N*-[1-(9, 10-Methanoanthracen-9(10*H*)-ylmethyl)-4-piperidinyl]-2-quinolinamine**

This compound was prepared from *N*-piperidin-4-ylquinolin-2-amine and 9-formyl-9,10-dihydro-9,10-methanoanthracene, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title
10 compound in 53% yield. ¹H NMR (400 MHz, THF-*d*₈) δ 7.77 (d, $J = 9.0$ Hz, 1H), 7.64 (d, $J = 9.1$ Hz, 1H), 7.57 (d, $J = 8.2$ Hz, 1H), 7.47 (t, $J = 8.4$ Hz, 1H), 7.27 (d, $J = 6.6$ Hz, 4H), 7.15 (t, $J = 8.0$ Hz, 1H), 6.99 - 6.90 (m, 4H), 6.68 (d, $J = 9.0$ Hz, 1H), 4.30 (s, 1H), 4.22 - 4.15 (m, 1H), 3.51 (s, 2H), 3.12 (d, $J = 11.9$ Hz, 2H), 2.63 (s, 2H), 2.52 (dt, $J = 2.6, 12.6$
15 Hz, 2H), 2.14 (d, $J = 13.2$ Hz, 2H), 1.59 (dq, $J = 4.4, 12.7$ Hz, 2H).

Example 24

***N*-(1*H*-Indol-3-ylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and indole-3-carboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 19% yield. ¹H
20 NMR (400 MHz, MeOH-*d*₄) δ 7.83 (d, $J = 8.9$ Hz, 1H), 7.63 (d, $J = 8.6$ Hz, 1H), 7.58 (d, $J = 8.2$ Hz, 1H), 7.41 (d, $J = 8.5$ Hz, 1H), 7.33 - 7.29 (m, 2H), 7.19 - 7.13 (m, 3H), 7.06 (t, $J = 7.7$ Hz, 1H), 6.72 (d, $J = 9.4$ Hz, 1H), 4.41 (s, 2H), 3.66 (t, $J = 6.1$ Hz, 2H), 3.10 (t, $J = 6.7$ Hz, 2H), 2.06 (quintet, $J = 6.6$ Hz, 2H).
25

Example 25

30 ***N*-(2-Naphthylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 2-naphthaldehyde, but the reaction was performed at room temperature (no microwave

heating single node) using NaBH_3CN , and purified on SiO_2 ($\text{CH}_2\text{Cl}_2:\text{MeOH}$ 40:1 \rightarrow 10:1, containing 1% HOAc) to give the title compound in 73% yield. ^1H NMR (400 MHz, $\text{MeOH}-d_4$) δ 7.91 - 7.87 (m, 4H), 7.80 - 7.77 (m, 1H), 7.61 (d, $J = 8.3$ Hz, 1H), 7.56 - 7.50 (m, 3H), 7.27 - 7.16 (m, 3H), 6.79 (d, $J = 9.1$ Hz, 1H), 4.38 (s, 2H), 3.68 (t, $J = 6.3$ Hz, 2H), 3.18 (t, $J = 7.2$ Hz, 2H), 2.12 (quintet, $J = 6.6$ Hz, 2H).

Example 26

***N*-(2, 2-Diphenylethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and diphenyl-acetaldehyde, but the reaction was performed at room temperature (no microwave heating single node) using NaBH_3CN , and purified on SiO_2 ($\text{CH}_2\text{Cl}_2:\text{MeOH}$ 30:1 \rightarrow 10:1, containing 1% HOAc) to give the title compound in 53% yield. ^1H NMR (400 MHz, $\text{MeOH}-d_4$) δ 7.86 (d, $J = 9.1$ Hz, 1H), 7.61 (d, $J = 7.0$ Hz, 1H), 7.45 (t, $J = 8.3$ Hz, 1H), 7.34 - 7.19 (m, 12H), 6.73 (d, $J = 8.9$ Hz, 1H), 4.32 (t, $J = 8.0$ Hz, 1H), 3.75 (d, $J = 8.0$ Hz, 2H), 3.58 (t, $J = 6.2$ Hz, 2H), 3.08 (t, $J = 7.2$ Hz, 2H), 2.05 - 1.98 (m, 2H).

Example 27

***N*-(1*H*-Indol-3-ylmethyl)-*N'*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and indole-3-carboxaldehyde, and purified using HPLC (95% 0.1 M ammoniumacetatebuffer:5% $\text{CH}_3\text{CN} \rightarrow$ 100% CH_3CN , 15 min 25 ml/min.) to give the title compound in 22% yield. ^1H NMR (400 MHz, $\text{MeOH}-d_4$) δ 7.60 (d, $J = 8.5$ Hz, 1H), 7.41 (d, $J = 8.2$ Hz, 1H), 7.31 (s, 1H), 7.18 - 7.02 (m, 4H), 6.96 (dd, $J = 2.7, 12.0$ Hz, 1H), 6.61 (s, 1H), 4.38 (s, 2H), 3.84 (s, 3H), 3.61 (t, $J = 5.8$ Hz, 2H), 3.09 (t, $J = 6.6$ Hz, 2H), 2.50 (d, $J = 0.8$ Hz, 3H), 2.04 (quintet, $J = 6.5$ Hz, 2H).

Example 28***N*-[(3, 4-Dichlorophenyl)methyl]-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3, 4-dichloro-benzaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 44% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.82 (d, *J* = 9.3 Hz, 1H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.50 (d, *J* = 2.2 Hz, 1H), 7.44 - 7.41 (m, 2H), 7.37 (d, *J* = 8.3 Hz, 1H), 7.24 (dd, *J* = 2.5, 10.5 Hz, 1H), 7.19 - 7.15 (m, 1H), 6.72 (d, *J* = 8.9 Hz, 1H), 3.92 (s, 2H), 3.59 (t, *J* = 7.5 Hz, 2H), 2.87 (t, *J* = 7.6 Hz, 2H), 1.96 (quintet, *J* = 6.7 Hz, 2H).

Example 29***N*-[(3, 4-Dichlorophenyl)methyl]-*N'*-(2-quinolinyl)-1, 4-cyclohexanediamine**

This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 4-diamine and 3, 4-dichlorobenzaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a mixture of isomers in 45% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.84 (d, *J* = 9.1 Hz, 1H), 7.65 - 7.46 (m, 5H), 7.35 (dd, *J* = 2.0, 10.3 Hz, 1H), 7.20 - 7.15 (m, 1H), 6.82 (d, *J* = 9.1 Hz, 1H), 4.20 - 4.16 (m, 1H), 3.95 (s, 2H), 2.92 - 2.85 (m, 1H), 2.22 - 2.16 (m, 1H), 2.02 - 1.98 (m, 2H), 1.89 - 1.84 (m, 2H), 1.79 - 1.67 (m, 3H).

Example 30

25

***N, N'*-Di-(2-quinolinyl)-1,3-propanediamine**

The title compound was isolated in 3% yield from synthesis of 2-quinolinyl-1, 3-propanediamine. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.77 (d, *J* = 8.5 Hz, 2H), 7.71 (d, *J* = 8.9 Hz, 2H), 7.55 (m, 4H), 7.20 (t, *J* = 7.8 Hz, 2H), 6.61 (d, *J* = 8.9 Hz, 2H), 3.59 (bs, 4H), 1.92 (bt, *J* = 5.7 Hz, 2H).

30

Example 31***N*-(2-Quinoliny)-*N'*-(2-quinolinylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 2-quinoline-
5 carboxaldehyde, and purified on SiO₂ (EtOAc:MeOH 1:0 → 0:1) to give the title
compound in 27% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 8.23 (d, *J* = 8.5 Hz, 1H), 7.98
(d, *J* = 8.5 Hz, 1H), 7.88 (d, *J* = 8.1 Hz, 1H), 7.77 (d, *J* = 8.9 Hz, 1H), 7.74 - 7.70 (m, 1H),
7.58 - 7.47 (m, 4H), 7.33 (t, *J* = 8.5 Hz, 1H), 7.12 (t, *J* = 8.0 Hz, 1H), 6.69 (d, *J* = 8.7 Hz,
1H), 4.13 (s, 2H), 3.60 (t, *J* = 6.6 Hz, 2H), 2.87 (t, *J* = 6.9 Hz, 2H), 1.96 (quintet, *J* = 6.7
10 Hz, 2H).

Example 32***N*-(1-Acetyl-1*H*-indol-3-yl)methyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 1-acetyl-3-
indolecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5%
CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 25% yield. ¹H
NMR (400 MHz, acetone-*d*₆, major rotamer) δ 7.77 (d, *J* = 8.9 Hz, 1H), 7.69 (d, *J* = 8.7
20 Hz, 1H), 7.61 (s, 1H), 7.57 (dd, *J* = 9.3, 1.4 Hz, 1H), 7.52 (d, *J* = 8.5 Hz, 1H), 7.38 (d, *J* =
7.5 Hz, 1H), 7.28 (s, 1H), 7.10 (d, *J* = 8.9 Hz, 2H), 7.02 - 6.98 (m, 1H), 6.69 (d, *J* = 8.9 Hz,
1H), 4.01 (s, 2H), 3.64 - 3.61 (m, 2H), 2.86 - 2.81 (m, 2H), 2.53 (s, 3H), 1.90 - 1.86 (m,
2H).

25

Example 33***N*-(Cyclopropylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and
30 cyclopropanecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate
buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in
17% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 8.07 (d, *J* = 8.1 Hz, 1H), 7.74 (t, *J* = 6.4 Hz,

2H), 7.65 (t, $J = 7.8$ Hz, 1H), 7.36 (t, $J = 7.5$ Hz, 1H), 6.93 (d, $J = 8.7$ Hz, 1H), 3.67 (t, $J = 6.6$ Hz, 2H), 3.16 (t, $J = 7.3$ Hz, 2H), 2.93 (d, $J = 7.5$ Hz, 2H), 2.10 (quintet, $J = 7.3$ Hz, 2H), 1.12 - 1.02 (m, 1H), 0.71 - 0.67 (m, 2H), 0.40 - 0.37 (m, 2H).

5 **Example 34**

***N*-(2-Quinoliny)-*N'*-(3-thienylmethyl)-1, 4-cyclohexanediamine**

This compound was prepared from *N*-quinolin-2-ylcyclohexane-1, 4-diamine and 3-thiophenecarboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate
10 buffer:5% CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound as a diastereomeric mixture in 27% yield. ¹H NMR (400 MHz, MeOH-*d*₄, major isomer) δ 7.78 (d, $J = 8.9$ Hz, 1H), 7.58 (d, $J = 8.5$ Hz, 1H), 7.55 (dd, $J = 9.3, 1.2$ Hz, 1H), 7.45 (t, $J = 8.5$ Hz, 1H), 7.35 (dd, $J = 7.9, 3.0$ Hz, 1H), 7.26 - 7.24 (m, 1H), 7.16 - 7.10 (m, 2H), 6.78 (d, $J = 9.1$ Hz, 1H), 4.18 - 4.16 (m, 1H), 3.81 (s, 2H), 2.65 (septet, $J = 4.1$ Hz, 1H), 1.92 - 1.83
15 (m, 2H), 1.80 - 1.64 (m, 5H), 1.64 - 1.54 (m, 1H).

Example 35

***N*-([1, 1'-Biphenyl]-4-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 4-biphenylcarboxaldehyde, but the reaction was performed at room temperature (no
20 microwave heating single node) using NaBH₃CN, and purified on SiO₂ (CH₂Cl₂:MeOH 30:1 → 10:1, containing 1% HOAc) to give the title compound in 46% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.84 (d, $J = 9.2$ Hz, 1H), 7.62 - 7.56 (m, 5H), 7.48 - 7.40 (m, 5H),
25 7.36 (t, $J = 7.1$ Hz, 1H), 7.23 (d, $J = 8.5$ Hz, 1H), 7.16 (t, $J = 8.5$ Hz, 1H), 6.74 (d, $J = 8.5$ Hz, 1H),
4.21 (s, 2H), 3.66 (t, $J = 5.8$ Hz, 2H), 3.08 (t, $J = 7.0$ Hz, 2H), 2.07 (m, 2H).

Example 36***N*-(6-Methoxy-4-methyl-2-quinolinyl)-*N'*-[3-(5-methyl-2-furanyl)butyl]-1, 3-propanediamine**

5 This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and 3-(5-methyl-2-furyl)butyraldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 46% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.54 (d, *J* = 8.9 Hz, 1H), 7.22 (dd, *J* = 2.6, 8.7 Hz, 1H), 7.19 (d, *J* = 2.8 Hz, 1H), 6.72 (d, *J* = 1.0 Hz, 1H), 5.96
10 - 5.94 (m, 2H), 3.92 (s, 3H), 3.56 (t, *J* = 6.6 Hz, 2H), 2.93 - 2.88 (m, 2H), 2.77 - 2.75 (m, 2H), 2.66 (t, *J* = 7.4 Hz, 2H), 2.53 (d, *J* = 0.8 Hz, 3H), 2.25 (d, *J* = 0.8 Hz, 3H), 1.90 - 1.82 (m, 2H), 1.72 - 1.67 (m, 1H), 1.21 (d, *J* = 7.0 Hz, 3H).

Example 37***N*-[[4-(Dimethylamino)phenyl]methyl]-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 4-dimethylaminobenzaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5%
20 CH₃CN → 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 22% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.85 (d, *J* = 9.0 Hz, 1H), 7.60 (dd, *J* = 1.5, 9.4 Hz, 1H), 7.39 (t, *J* = 8.5 Hz, 1H), 7.24 - 7.17 (m, 4H), 6.74 (d, *J* = 9.1 Hz, 1H), 6.70 (d, *J* = 9.0 Hz, 2H), 4.07 (s, 2H), 3.65 (t, *J* = 6.2 Hz, 2H), 3.04 (t, *J* = 6.6 Hz, 2H), 2.94 (s, 6H), 2.05 (quintet, *J* = 6.6 Hz, 2H).

25

Example 38***N*-(1*H*-Pyrrol-2-ylmethyl)-*N'*-(2-quinolinyl)-1, 3-propanediamine**

30 This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and pyrrole-2-carboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 61% yield. ¹H

NMR (400 MHz, MeOH- d_4) δ 7.86 (d, J = 9.3 Hz, 1H), 7.61 (dd, J = 1.7, 9.8 Hz, 1H), 7.46 - 7.42 (m, 1H), 7.22 - 7.18 (m, 2H), 6.81 (dd, J = 1.5, 4.3 Hz, 1H), 6.75 (d, J = 8.9 Hz, 1H), 6.22 (dd, J = 1.8, 5.0 Hz, 1H), 6.13 (t, J = 3.2 Hz, 1H), 4.18 (s, 2H), 3.66 (t, J = 6.3 Hz, 2H), 3.03 (t, J = 6.8 Hz, 2H), 2.04 (quintet, J = 6.5 Hz, 2H).

5

Example 39

***N*-[3-(5-Methyl-2-furanyl)butyl]-*N'*-(2-quinolinyl)-1, 3-propanediamine**

10 This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-(5-methyl-2-furyl)-butyraldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN \rightarrow 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 19% yield. ¹H NMR (400 MHz, MeOH- d_4) δ 7.86 (d, J = 8.9 Hz, 1H), 7.62 (dd, J = 1.2, 9.3 Hz, 2H), 7.58 (d, J = 8.5 Hz, 2H), 7.53 - 7.49 (m, 2H), 7.24 - 7.20 (m, 1H), 6.76 (d, J = 9.1 Hz, 1H), 5.86 (d, J = 3.0 Hz, 2H), 5.84 - 5.83 (m, 2H), 3.62 (t, J = 6.4 Hz, 2H), 2.98 (t, J = 6.7 Hz, 2H), 2.92 - 2.75 (m, 4H), 2.18 (d, J = 0.8 Hz, 3H), 1.98 (quintet, J = 6.6 Hz, 3H), 1.90 (s, 3H), 1.87 - 1.78 (m, 4H).

15

Example 40

***N*-[(5-Nitro-3-thienyl)methyl]-*N'*-(2-quinolinyl)-1, 3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 5-nitrothiophene-3-carboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN \rightarrow 100% CH₃CN, 15 min 25 ml/min.) to give the title compound in 64% yield. ¹H NMR (400 MHz, MeOH- d_4) δ 7.94 (d, J = 1.7 Hz, 1H), 7.87 (d, J = 9.1 Hz, 1H), 7.78 (d, J = 1.0 Hz, 1H), 7.61 (d, J = 8.5 Hz, 1H), 7.48 - 7.40 (m, 2H), 7.20 (t, J = 7.4 Hz, 1H), 6.76 (d, J = 8.8 Hz, 1H), 4.11 (s, 2H), 3.64 (t, J = 6.6 Hz, 2H), 3.03 (t, J = 6.8 Hz, 2H), 2.04 (quintet, J = 6.6 Hz, 2H).

25

30

Example 41***N*-(6-Methoxy-4-methyl-2-quinolinyl)-*N'*-[(5-nitro-3-thienyl)methyl]-1, 3-propanediamine**

5 This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and 5-nitrothiophene-3-carboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 63% yield. ¹H NMR (400 MHz, DMF-*d*₇) δ 8.09 (d, *J* = 1.8 Hz, 1H), 7.87 - 7.87 (m, 1H), 7.46 (d, *J* = 8.9 Hz, 1H), 7.19 (d, *J* = 2.8 Hz, 1H), 7.15 (dd, *J* = 2.8, 11.7 Hz, 1H), 6.67 (d, *J* = 1.0 Hz, 1H), 3.88 (s, 3H), 3.78 (s, 2H), 3.54 (t, *J* = 6.6 Hz, 2H), 2.70 (t, *J* = 6.7 Hz, 2H), 2.49 (d, *J* = 1.0 Hz, 3H), 1.82 (quintet, *J* = 6.7 Hz, 2H).

Example 42

15

***N*-(6-Methoxy-4-methyl-2-quinolinyl)-*N'*-(1*H*-pyrrol-2-ylmethyl)-1, 3-propanediamine**

This compound was prepared from *N*-(6-methoxy-4-methyl-2-quinolinyl)-1, 3-propanediamine and pyrrole-2-carboxaldehyde, and purified using HPLC (95% 0.1 M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 min 25 ml/min.) to give the title compound in 83% yield. ¹H NMR (400 MHz, DMF-*d*₇) δ 7.56 (d, *J* = 8.9 Hz, 1H), 7.36 (d, *J* = 2.8 Hz, 1H), 7.31 (dd, *J* = 3.0, 11.9 Hz, 1H), 6.95 - 6.93 (m, 1H), 6.86 (d, *J* = 0.8 Hz, 1H), 6.19 - 6.17 (m, 1H), 6.15 - 6.13 (m, 1H), 4.13 (s, 2H), 4.05 (s, 3H), 3.71 (t, *J* = 6.5 Hz, 2H), 2.99 (t, *J* = 6.9 Hz, 2H), 2.66 (d, *J* = 0.8 Hz, 3H), 2.11 - 2.10 (m, 2H).

25

Example 43***N*-[(3,4-Dichlorophenyl)methyl]-*N'*-methyl-*N'*-2-quinolinyl)-1, 3-propanediamine**

30 The title compound was isolated from the synthesis of Example 22. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.93 (d, *J* = 9.3 Hz, 1H), 7.60 (d, *J* = 7.7 Hz, 1H), 7.45 - 7.37 (m, 3H), 7.32 (d, *J* = 8.3 Hz, 1H), 7.18 - 7.14 (m, 1H), 7.09 (dd, *J* = 2.0, 10.3 Hz, 1H), 6.99 (d, *J* = 9.3

Hz, 1H), 3.83 (t, $J = 6.7$ Hz, 2H), 3.65 (s, 2H), 3.12 (s, 3H), 2.58 (t, $J = 6.7$ Hz, 2H), 1.91 (quintet, $J = 7.0$ Hz, 2H).

Example 44

***N*-[1-(2,5-Dimethyl-3-thienyl)ethyl]-*N'*-(2-quinolinyl)-1,3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 3-acetyl-2, 5-dimethylthiophene, but subjected to microwave heating single node 120 °C, 10 min., and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in 26% yield. ¹H

NMR (400 MHz, MeOH-*d*₄) δ 7.84 (d, $J = 9.1$ Hz, 1H), 7.61 (dd, $J = 1.7, 9.7$ Hz, 1H), 7.49 - 7.45 (m, 1H), 7.33 (d, $J = 9.1$ Hz, 1H), 7.21 (t, $J = 7.8$ Hz, 1H), 6.72 (d, $J = 9.4$ Hz, 1H), 6.43 (s, 1H), 4.40 (q, $J = 6.9$ Hz, 1H), 3.71 - 3.55 (m, 2H), 2.99 - 2.83 (m, 2H), 2.27 (s, 3H), 2.25 (s, 3H), 2.06 - 1.95 (m, 2H), 1.91 (s, 3H).

Example 45

***N*-[1-(2,5-Dichloro-thiophen-3-yl)-ethyl]-*N'*-(2-quinolinyl)-1,3-propanediamine**

This compound was prepared from *N*-quinolin-2-yl-1, 3-propanediamine and 1-(2,5-dichloro-thiophen-3-yl)-ethanone, but subjected to microwave heating single node 120 °C, 5 min., and purified on SiO₂ (CH₂Cl₂:MeOH 10:0 → 4:1) to give the title compound in

11% yield. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.79 (d, $J = 8.8$ Hz, 1H), 7.56 (bt, $J = 8.0$ Hz, 2H), 7.49 - 7.44 (m, 1H), 7.16 (dt, $J = 1.2, 7.4$ Hz, 1H), 6.70 (s, 1H), 6.69 (bd, $J = 9.0$ Hz, 1H), 3.93 (q, $J = 6.7$ Hz, 1H), 3.59 (m, 1H), 3.47 (m, 1H), 2.50 (m, 2H), 1.81 (m, 2H), 1.28 (d, $J = 6.9$ Hz, 3H).

Example 46

***N*-[1-(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-quinolin-2-ylcyclohexane-1,3-diamine**

A solution of *N*-quinolin-2-ylcyclohexane-1,3-diamine (1.01 mmol, 0.243 g) and 1-acetyl-1*H*-indole-3-carboxaldehyde (0.63 mmol, 0.118 g) in MeOH:CH₂Cl₂ (1:2, containing 1% HOAc, 9 mL) was stirred at ambient temperature for 1 h, after which a solution of

NaBH₃CN (2.50 mmol, 0.16 g) in MeOH (1.5 mL) was added. The reaction mixture was stirred at room temperature until LC/MS indicated that starting material was consumed.

Methanol (10 mL) was added and the reaction mixture was concentrated. The residue was

purified on SiO₂ eluted with CH₂Cl₂:MeOH (95:5) and finally CH₂Cl₂:MeOH (9:1) to give 0.095 g (37%) of the title compound as a diastereomeric mixture (approx. 3:1). ¹H NMR (400 MHz, MeOH-*d*₄) δ 8.36 (d, *J* = 8.1 Hz, 1H, major isomer), 8.32 (d, *J* = 8.3 Hz, 1H, minor isomer), 7.77 (d, *J* = 8.9 Hz, 1H), 7.63-7.12 (m, 8H), 6.73 (d, *J* = 8.9 Hz, 1H, minor isomer), 6.69 (d, *J* = 8.9 Hz, 1H, major isomer), 4.42 (m, 1H, minor isomer), 4.06-3.96 (m, 1H, major isomer), 3.97 (s, 2H, major isomer), 3.96 (s, 2H, minor isomer), 3.00 (m, 1H, minor isomer), 2.82 (tt, *J* = 11.2, 3.6 Hz, 1H, major isomer), 2.60 (s, 3H, major isomer), 2.50-2.42 (m, 1H), 2.46 (s, 3H, minor isomer), 2.14-1.09 (m, 7H). ¹³C NMR (75 MHz, DMSO-*d*₆) δ (mixture of isomers) 168.4, 156.0, 148.0, 137.4, 137.2, 136.0, 129.8, 129.4, 127.3, 125.9, 125.3, 123.5, 123.2, 122.7, 121.8, 121.5, 119.0, 118.8, 116.7, 111.6, 111.0, 55.4, 52.3, 48.5, 46.0, 42.0, 41.8, 39.5, 32.7, 32.6, 31.7, 23.9, 22.1, 19.9.
LC-MS [M+H]⁺ 413

Example 47

(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine

a) *tert*-butyl {(1*S*,3*S*)-3-[(6-methoxy-4-methylquinolin-2-yl)amino]cyclopentyl}carbamate

A mixture of 2-chloro-6-methoxy-4-methylquinoline (3.33 mmol, 0.690 g), *tert*-butyl [(1*S*,3*S*)-3-aminocyclopentyl]carbamate (5.0 mmol, 1.00 g), NaO^tBu (4.66 mmol, 0.45 g), Pd(OAc)₂ (0.33 mmol, 0.075 g), and BINAP (0.33 mmol, 0.207 g) in toluene (30 mL) was stirred at 100 °C under nitrogen until LC/MS indicated that starting material was consumed. The reaction mixture was cooled to room temperature, poured into Et₂O (300 mL) and washed with brine. The organic layer was then separated, dried over Na₂SO₄ and evaporated to dryness. The residue was purified on a SiO₂ column eluted with CH₂Cl₂:MeOH (95:5) to give 0.618 g (50%) of the title compound.
LC-MS [M+2H]⁺ 373

b) (1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)cyclopentane-1,3-diamine

Tert-butyl {(1*S*,3*S*)-3-[(6-methoxy-4-methylquinolin-2-yl)amino]cyclopentyl}carbamate (1.48 mmol, 0.550 g) and TFA (3 mL) in CHCl₃ (7 mL) was stirred at rt. for 6 hours. LC

indicated that starting material was consumed. The mixture was then evaporated to dryness. pH was set to 10 with a 2 N NaOH solution and then extracted with EtOAc. The organic layer was separated, dried on MgSO₄ and concentrated, to give 0.400 g (99%) of the title compound. ¹H NMR (300 MHz, CDCl₃) δ 7.57 (d, 1H), 7.16-7.20 (dd 1H), 7.04 (d, 1H), 6.51 (s, 1H), 5.24 (br, 1H), 4.44 (m, 1H), 3.86 (s, 3H), 3.50 (m, 1H), 2.73 (br, 2H), 2.51 (s, 3H), 2.26 (m, 2H), 2.06 (m, 1H), 1.85 (m, 1H), 1.41 (m, 2H).

c) (1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine

(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)cyclopentane-1,3-diamine (0.74 mmol, 0.200 g) and thiophene-3-carboxylaldehyde (0.74 mmol, 0.083 g) in MeOH:CH₂Cl₂ (1:1, containing 1% HOAc, 5 mL) was stirred at ambient temperature for 1 h, after which a solution of NaBH₃CN (1.48 mmol, 0.093 g) in MeOH (1 mL) was added. The reaction mixture was stirred at room temperature until LC-MS indicated that starting material was consumed. Methanol (5 mL) was added and the reaction mixture was concentrated. The residue was dissolved in MeCN and filtrated. The filtrate was then evaporated to dryness, dissolved in MeCN (10 mL) and purified by prep. HPLC (H₂O:MeCN) to give 0.180 g (95%) of the title compound. ¹H NMR (300 MHz, CDCl₃) δ 7.58 (d, 1H), 7.27-7.29 (m, 1H), 7.19-7.23 (dd, 1H), 7.13 (d, 1H), 7.04-7.08 (m, 2H), 6.53 (s, 1H), 4.75 (br, 1H), 4.38 (m, 1H), 3.89 (s, 3H), 3.80 (s, 2H), 3.33-3.38 (m, 1H), 2.54 (s, 3H), 2.31 (m, 1H), 1.95-2.08 (m, 2H), 1.85 (m, 1H), 1.49-1.53 (m, 2H). ¹³C NMR (CDCl₃) δ 155.6, 155.1, 144.9, 141.7, 128.0, 127.8, 126.2, 124.2, 122.0, 120.7, 111.4, 104.0, 57.7, 56.0, 52.3, 47.9, 41.2, 32.9, 32.2, 19.6.

MS (ESI) 368 (M + H⁺).

Example 48

(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclopentane-1,3-diamine

(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)cyclopentane-1,3-diamine (0.74 mmol, 0.200 g) and 1-Methyl indole-3-carboxyaldehyde (0.74 mmol, 0.118 g) in MeOH:CH₂Cl₂ (1:1, containing 1% HOAc, 5 mL) was stirred at ambient temperature for 1 h, after which a

solution of NaBH₃CN (1.48 mmol, 0.093 g) in MeOH (1 mL) was added. The reaction mixture was stirred at room temperature until LC-MS indicated that starting material was consumed. Methanol (5 mL) was added and the reaction mixture was concentrated. The residue was dissolved in MeCN and filtrated. The filtrate was then evaporated to dryness, dissolved in MeCN (10 mL) and purified by prep. HPLC (H₂O:MeCN) to give 0.050 g (16%) of the title compound. ¹H NMR (300 MHz, CDCl₃) δ 7.61-7.68 (m, 2H), 7.25-7.30 (m, 3H), 7.10-7.15 (m, 2H), 7.03 (s, 1H), 6.56 (s, 1H), 4.90 (br, 1H), 4.40-4.44 (q, 1H), 3.98 (s, 2H), 3.81 (s, 3H), 3.48 (s, 3H), 3.44-3.48 (m, 1H), 2.56 (s, 3H), 2.31-2.35 (m, 1H), 2.02-2.10 (m, 2H), 1.84-1.91 (m, 1H), 1.54-1.60 (m, 2H). ¹³C NMR (CDCl₃) δ 155.4, 154.8, 144.6, 143.0, 137.2, 127.6, 127.5, 123.9, 121.8, 120.4, 119.1, 118.9, 113.2, 111.0, 109.4, 103.7, 57.4, 55.7, 52.1, 43.2, 40.8, 32.7, 32.6, 31.8, 19.3. LC-MS [M+H]⁺ 415.

Example 49

***N*-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine**

To a stirred solution of *N*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine (0.526 mmol, 0.150 g) and 1-acetyl-1*H*-indole-3-carbaldehyde (0.53 mmol, 0.098 g) in CH₂Cl₂/MeOH 2:1 containing 1% HOAc (5 mL), sodium cyanoborohydride (0.89 mmol, 0.056 g) was added. After 24 h, the mixture was concentrated and purified by flash chromatography, to give 0.119 g (50%) of the major diastereomer of the title compound. ¹H NMR (400 MHz, CDCl₃) δ 8.43 (d, *J* = 8.1 Hz, 1H), 7.61-7.57 (m, 2H), 7.37-7.26 (m, 3H), 7.19 (dd, *J* = 9.1, 2.8 Hz, 1H), 7.06 (d, *J* = 12.8 Hz, 1H), 6.42 (s, 1H), 4.88 (br, 1H), 4.04-3.95 (m, 3H), 3.86 (s, 3H), 2.82 (m, 1H), 2.58 (s, 3H), 2.48 (s, 3H), 2.44-2.38 (m, 1H), 2.11-1.82 (m, 4H), 1.52-1.11 (m, 4H); ¹³C NMR (101 MHz, CDCl₃) δ 168.6, 155.0, 154.7, 144.0, 143.5, 136.2, 130.0, 127.9, 125.4, 124.1, 123.7, 122.7, 121.9, 120.0, 119.0, 116.8, 112.1, 103.8, 55.7 (2C), 48.7, 42.1, 40.1, 33.1, 32.8, 24.1, 22.4, 19.1; LC-MS [M+H]⁺ 457.3.

A minor diastereomer was isolated and further purified by HPLC (95% 0.1M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 mL/min) to give 0.027 g (11%) of the minor diastereomer of the title compound. ¹H NMR (500 MHz, CDCl₃) δ 8.43 (bs, 1H), 7.62 (d, *J* = 7.5 Hz, 1H), 7.57 (d, *J* = 9.1 Hz, 1H), 7.37-7.25 (m, 3H), 7.18 (d, *J* = 8.3 Hz,

1H), 7.07 (s, 1H), 6.50 (s, 1H), 4.69 (bs, 1H), 4.29 (bs, 1H), 4.01 (d, $J = 13.6$ Hz, 1H), 3.96 (d, $J = 13.6$ Hz, 1H), 3.88 (s, 3H), 3.03 (bs, 1H), 2.53 (s, 3H), 2.52 (s, 3H), 1.92-1.4 (m, 9H); LC-MS $[M+H]^+$ 457.3.

5 **Example 50**

***N*-(1*H*-indol-3-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine**

The title compound was isolated from synthesis of Example 49 and further purified by HPLC (95% 0.1M ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 mL/min) to
10 give 0.013 g (6%) of the title compound as a single diastereomer. ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.62 (d, $J = 7.9$ Hz, 1H), 7.53 (d, $J = 9.1$ Hz, 1H), 7.36 (d, $J = 8.3$ Hz, 1H), 7.26 (s, 1H), 7.17-7.09 (m, 3H), 7.06 (m, 1H), 6.57 (s, 1H), 4.05 (s, 2H), 3.92 (tt, $J = 11.4$, 3.8 Hz, 1H), 3.86 (s, 3H), 2.86 (tt, $J = 11.3$, 3.7 Hz, 1H), 2.49 (s, 3H), 2.47-2.41 (m, 1H), 2.08-2.02 (m, 1H), 1.90-1.82 (m, 1H), 1.52-1.40 (m, 1H), 1.24-1.11 (m, 3H); LC-MS
15 $[M+H]^+$ 415.3.

Example 51

***N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine**

N-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine (0.16 mmol, 0.046 g) in
20 CH₂Cl₂/MeOH 1:1 (1.2 mL), thiophene-3-carboxaldehyde (0.12 mmol, 0.014 g) in CH₂Cl₂ (0.6 mL) and HOAc (0.060 mL) was added to Pol-BH₃CN (150 mg, pre-swollen in CH₂Cl₂, 0.6 mL). The resultant slurry was subjected to microwave heating single node 100 °C, 5 min. The resin was filtered and washed with portions (1-2 mL) of CH₂Cl₂ and MeOH, and the filtrate was concentrated. The residue was purified on HPLC (95% 0.1M
25 ammonium acetate buffer:5% CH₃CN → 100% CH₃CN, 10 mL/min) to give 0.021 g (39%) of the title compound as a mixture of diastereomers (~5:1). ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.56 (m, 1H, minor isomer), 7.55 (d, $J = 9.1$ Hz, 1H, major isomer), 7.44-7.40 (m, 2H), 7.33 (dd, $J = 5.0$, 3.0 Hz, 1H, minor isomer), 7.25 (m, 1H, minor isomer), 7.19-7.13 (m, 3H) 7.07 (dd, $J = 5.0$, 1.2 Hz, 1H, minor isomer), 6.66 (bs, 1H, minor
30 isomer), 6.59 (bs, 1H, major isomer), 4.36 (m, 1H, minor isomer), 4.02 (s, 2H, major isomer), 4.01 (s, 2H, minor isomer), 3.94 (tt, $J = 11.5$, 3.7 Hz, 1H, major isomer), 3.87 (s, 3H, minor isomer), 3.86 (s, 3H, major isomer), 3.10 (m, 1H, minor isomer), 2.94 (tt, $J =$

11.6, 3.7 Hz, 1H, major isomer), 2.52-2.46 (m, 1H, major isomer), 2.52 (s, 3H, minor isomer), 2.50 (s, 3H, major isomer), 2.34-2.28 (m, 1H, minor isomer), 2.12-1.15 (m, 7H); ^{13}C NMR (101 MHz, MeOH- d_4 , major isomer) δ 156.6, 156.2, 145.7, 143.7, 137.9, 129.0, 127.5, 127.3, 125.4, 125.2, 120.9, 114.3, 104.9, 56.3, 56.0, 49.3, 45.1, 38.9, 33.6, 31.4, 23.9, 18.9; LC-MS $[\text{M}+\text{H}]^+$ 382.2.

Example 52

N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclohexane-1,3-diamine

N-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine (0.16 mmol, 0.046 g) in $\text{CH}_2\text{Cl}_2/\text{MeOH}$ 1:1 (1.2 mL), 1-methylindole-3-carboxaldehyde (0.13 mmol, 0.021 g) in CH_2Cl_2 (0.6 mL) and HOAc (0.060 mL) was added to $\text{PoI-BH}_3\text{CN}$ (150 mg, pre-swollen in CH_2Cl_2 , 0.6 mL). The resultant slurry was subjected to microwave heating single node 100 $^\circ\text{C}$, 10 min. The resin was filtered and washed with portions (1-2 mL) of CH_2Cl_2 and MeOH, and the filtrate was concentrated. The residue was purified on HPLC (95% 0.1M ammonium acetate buffer:5% $\text{CH}_3\text{CN} \rightarrow 100\% \text{CH}_3\text{CN}$, 10 mL/min) to give 0.021 g (34%) of the title compound as a mixture of diastereomers (~6:1). ^1H NMR (400 MHz, MeOH- d_4) δ 7.65 (d, $J = 8.1$ Hz, 1H, major isomer), 7.59-7.55 (m, 1H, minor isomer), 7.54 (d, $J = 9.1$ Hz, 1H, major isomer), 7.37 (d, $J = 8.3$ Hz, 1H, major isomer), 7.30 (d, $J = 8.3$ Hz, 1H, minor isomer), 7.27 (s, 1H, major isomer), 7.23-7.07 (m, 5H), 7.01-6.97 (m, 1H, minor isomer), 6.62 (s, 1H, minor isomer), 6.58 (s, 1H, major isomer), 4.36 (m, 1H, minor isomer), 4.20 (s, 2H), 3.95 (tt, $J = 11.4, 3.7$ Hz, 1H, major isomer), 3.87 (s, 3H, minor isomer), 3.85 (s, 3H, major isomer), 3.78 (s, 3H, major isomer), 3.59 (s, 3H, minor isomer), 3.21 (m, 1H, minor isomer), 3.07 (tt, $J = 11.5, 3.4$ Hz, 1H, major isomer), 2.58-2.40 (m, 1H), 2.51 (s, 3H, minor isomer), 2.49 (s, 3H, major isomer), 2.18-1.19 (m, 7H); LC-MS $[\text{M}+\text{H}]^+$ 429.3.

Example 53***N*-(1-benzofuran-2-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine**

5 *N*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine (0.14 mmol, 0.040 g) in CH₂Cl₂/MeOH 1:1 (1.2 mL), benzofuran-2-carboxaldehyde (0.13 mmol, 0.018 g) in CH₂Cl₂ (0.6 mL) and HOAc (0.060 mL) was added to Pol-BH₃CN (150 mg, pre-swollen in CH₂Cl₂, 0.6 mL). The resultant slurry was subjected to microwave heating single node 100 °C, 10 min. The resin was filtered and washed with portions (1-2 mL) of CH₂Cl₂ and
10 MeOH, and the filtrate was concentrated. The residue was purified on a Biotage Horizon 25 mm silica column (linear gradient EtOAc/MeOH 19:1, containing 1% NEt₃ → EtOAc/MeOH 1:1, containing 1% NEt₃, 10 mL/min) to give 0.015 g (26%) of the title compound as a mixture of diastereomers (~10:1). ¹H NMR (400 MHz, MeOH-*d*₄) δ 7.54-7.10 (m, 7H), 6.68 (s, 1H, major isomer), 6.61 (s, 1H, minor isomer), 6.57 (s, 1H, major
15 isomer), 6.47 (s, 1H, minor isomer), 4.31 (m, 1H, minor isomer), 3.95 (s, 2H), 3.95-3.85 (m, 1H, major isomer), 3.85 (s, 3H), 2.89 (m, 1H, minor isomer), 2.72 (tt, *J* = 11.2, 3.6 Hz, 1H, major isomer), 2.48 (s, 3H), 2.40-2.34 (m, 1H), 2.06-1.05 (m, 7H); LC-MS [M+H]⁺ 416.2.

Example 54***N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(pyridin-2-ylmethyl)cyclohexane-1,3-diamine**

N-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine (0.14 mmol, 0.040 g) in CH₂Cl₂/MeOH 1:1 (1.2 mL), pyridin-2-carboxaldehyde (0.13 mmol, 0.014 g) in CH₂Cl₂
25 (0.6 mL) and HOAc (0.060 mL) was added to Pol-BH₃CN (150 mg, pre-swollen in CH₂Cl₂, 0.6 mL). The resultant slurry was subjected to microwave heating single node 100 °C, 10 min. The resin was filtered and washed with portions (1-2 mL) of CH₂Cl₂ and MeOH, and the filtrate was concentrated. The residue was purified on a Biotage Horizon 25 mm silica column (linear gradient EtOAc/MeOH 19:1, containing 1% NEt₃ →
30 EtOAc/MeOH 1:1, containing 1% NEt₃, 10 mL/min) to give 0.015 g (45%) of the title compound as a mixture of diastereomers (~10:1). ¹H NMR (400 MHz, MeOH-*d*₄) δ 8.49 (m, 1H, major isomer), 8.42 (m, 1H, minor isomer), 7.78 (td, *J* = 7.7, 1.8 Hz, 1H, major

isomer), 7.65 (td, $J = 7.7, 1.8$ Hz, 1H, minor isomer), 7.52 (d, $J = 9.1$ Hz, 1H, major isomer), 7.44 (d, $J = 7.9$ Hz, 1H, major isomer), 7.37 (d, $J = 7.9$ Hz, 1H, minor isomer), 7.30-7.27 (m, 1H), 7.23-7.08 (m, 2H), 6.64 (bs, 1H, minor isomer), 6.57 (bs, 1H, major isomer), 4.36 (m, 1H, minor isomer), 3.95-3.87 (m, 1H, major isomer), 3.92 (s, 2H), 3.86 (s, 3H, minor isomer), 3.85 (s, 3H, major isomer), 3.29 (m, 1H, minor isomer), 2.69 (tt, $J = 11.2, 3.7$ Hz, 1H, major isomer), 2.50 (s, 3H, minor isomer), 2.49 (s, 3H, major isomer), 2.40-2.32 (m, 1H), 2.08-1.98 (m, 2H), 1.88-1.07 (m, 5H); LC-MS $[M+H]^+$ 377.2.

Example 55

10 *N*-(4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine

N-(4-methylquinolin-2-yl)cyclohexane-1,3-diamine (75 mg, 0.29 mmol) in 2 mL of CH_2Cl_2 /MeOH 1:1, and 3-thiophenylaldehyde (26 mg, 0.23 mmol) in 1 mL of CH_2Cl_2 , and 0.10 mL of acetic acid were added to $Pol-BH_3CN$ (0.25 g, preswollen in 1 mL of CH_2Cl_2).
15 The resultant slurry was subjected to single node microwave heating (100°C for 10 min). The resin was filtered and washed with 1-2 mL portions of CH_2Cl_2 and MeOH. The filtrates were combined and poured onto a 1 g SCX-2 prepacked ion-exchange column, washed with 10 mL of MeOH and the product was eluted with MeOH containing 10% of Et_3N . The purity was not satisfactory and the product was further purified on a Biotage
20 Horizon 12 mm silica column (linear gradient EtOAc/MeOH 9:1 \rightarrow EtOAc/MeOH 1:1, 10 mL/min) to give 20 mg (19%) of the title compound as a mixture of diastereomers (~3:1).
 1H NMR (300 MHz, MeOH- d_4) δ 7.68-7.75 (m, 1H), 7.5-7.6 (m, 1H), 7.0-7.5 (m, 5H), 6.61 (bs, 1H, minor isomer), 6.54 (bs, 1H, major isomer), 4.36 (m, 1H, minor isomer), 4.11 (s, 2H, major isomer), 4.09 (s, 2H, minor isomer), 3.95 (m, 1H, major isomer), 3.09 (m,
25 1H, major isomer; minor isomer obscured under the MeOH- d_4 signal), 2.35-2.6 (m, 4H; thereof 2.48, 3H, minor isomer, and 2.46, 3H, major isomer), 1.1-2.2 (m, 7H).

^{13}C NMR (75 MHz, MeOH- d_4 , major isomer) δ 179.4, 157.3, 148.0, 146.7, 134.7, 130.4, 128.9, 128.0, 127.0, 125.6, 124.8, 123.0, 113.9, 68.1, 56.4, 44.2, 37.5, 33.1, 30.2, 23.8,
30 18.8.

LC-MS $[M+H]^+$ 352.3.

APPENDIX

Names/reference numbers of starting materials

- 5 **Commercial starting material (CAS no):** 2-chloroquinoline, 612-62-4; 2-chloro-6-methoxy-4-methylquinoline, 6340-55-2; 1,3-diaminopropane, 109-76-2; ethylenediamine, 107-15-3; 1, 3-cyclohexanediamine, 3385-21-5; 1, 4- cyclohexanediamine, 3114-70-3; 4-aminopiperidine, 13035-19-3; *N*-methyl-1, 3-propanediamine, 6291-84-5; 3-thiophenecarboxaldehyde, 498-62-4; 3-acetylthiophene, 1468-83-3; 4-keto-4, 5, 6, 7-tetrahydrothianaphthene, 13414-95-4; 3-acetylthianaphthene, 1128-05-8; 2-thiophenecarboxaldehyde, 98-03-3; 5-nitrothiophene-3-carboxaldehyde, 75428-45-4; 3-acetyl-2,5-dimethylthiophene, 2530-10-01; 1-acetyl-3-indolecarboxaldehyde, 22948-94-3; indole-3-carboxaldehyde, 487-89-8; pyrrole-2- carboxaldehyde, 1003-29-8; 2, 4, 6-trimethyl-benzaldehyde, 487-68-3; phenylacetaldehyde, 122-78-1; 3, 4-dichlorobenzaldehyde, 6287-38-3; 2-naphthaldehyde, 66-99-9; 2-quinolinecarboxaldehyde, 5470-96-2; diphenylacetaldehyde, 947-91-1; 4-biphenylcarboxaldehyde, 3218-36-8; 4-dimethylaminobenzaldehyde, 100-10-7; 3-furaldehyde, 498-60-2; 3-(5-methyl-2-furyl)butyraldehyde, 31704-80-0; cyclopropanecarboxaldehyde, 1489-69-6; 1-methylindole-3-carboxaldehyde, 19012-03-4; benzofuran-2-carboxaldehyde, 4265-16-1; 20 pyridin-2-carboxaldehyde, 1121-60-4 3-acetyl-2,5-dichlorothiophene, 36157-40-1; (-)-2-azabicyclo[2.2.1]hept-5-en-3-one, 79200-56-9 and 2-chloro-4-methylquinoline 634-47-9

Pharmacological Properties25 MCH1 receptor radioligand binding.

Assays were performed on membranes prepared from HEK293 cells stably expressing the human Melanin concentrating hormone receptor 1 (MCH1r) (Lembo et al. Nature Cell Biol 1 267-271). Assays were performed in a 96-well plate format in a final reaction

30 volume of 200 μ l per well. Each well contained 6,1 μ g of membrane proteins diluted in binding buffer (50 mM Tris, 3 mM MgCl₂, 0.05 % bovine serum albumin (BSA) and the radioligand ¹²⁵I-MCH (IM344 Amersham) was added to give 10 000 cpm (counts per

minute) per well. Each well contained 2 μ l of the appropriate concentration of competitive antagonist prepared in DMSO and left to stand at room temperature for 60 minutes. Non-specific binding was determined as that remaining following incubation with 1 μ M MCH (Melanin concentrating hormone, H-1482 Bachem). The reaction was terminated by
5 transfer of the reaction to GF/A filters using a Micro96 Harvester (Skatron Instruments, Norway). Filters were washed with assay buffer. Radioligand retained on the filters was quantified using a1450 Microbeta TRILUX (Wallac , Finland).

Non-specific binding was subtracted from all values determined. Maximum binding was
10 that determined in the absence of any competitor following subtraction of the value determined for non-specific binding. Binding of compounds at various concentrations was plotted according to the equation

$$y = A + ((B - A) / (1 + ((C/x)^D)))$$

15

and IC₅₀ estimated where

A is the bottom plateau of the curve i.e. the final minimum y value

B is the top of the plateau of the curve i.e. the final maximum y value

20 C is the x value at the middle of the curve. This represents the log EC₅₀ value when A + B = 100

D is the slope factor.

x is the original known x values.

y is the original known y values.

25

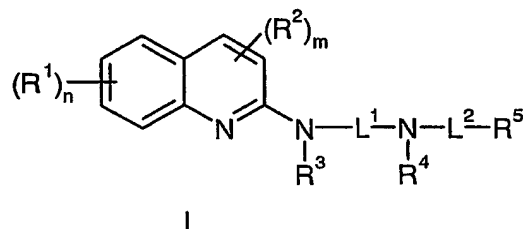
The compounds exemplified herein had an IC₅₀ of less than 2 μ molar in the above assay. Preferred compounds had an activity of less than 1 μ molar. For Example the IC₅₀s of Examples 2, 29 and 53 were 0.01, 0.40 and 0.56 μ mol, respectively.

30 Assays were also performed on membranes prepared from HEK293 cells stably expressing the rat Melanin concentrating hormone receptor 1 (MCH1r) (Lembo et al. Nature Cell Biol 1 267-271). Assays were performed in a 96-well plate format in a final reaction

volume of 200 μ l per well. Each well contained 5 μ g of membrane proteins diluted in binding buffer (50 mM Tris, 3 mM MgCl₂, 0.05 % bovine serum albumin (BSA) and the radioligand ¹²⁵I-MCH (IM344 Amersham) was added to give 10 000 cpm (counts per minute) per well. Each well contained 2 μ l of the appropriate concentration of competitive
5 antagonist prepared in DMSO and left to stand at room temperature for 60 minutes. Non-specific binding was determined as that remaining following incubation with 1 μ M MCH (Melanin concentrating hormone, H-1482 Bachem). The reaction was terminated by transfer of the reaction to GF/A filters using a Micro96 Harvester (Skatron Instruments, Norway). Filters were washed with assay buffer. Radioligand retained on the filters was
10 quantified using a1450 Microbeta TRILUX (Wallac , Finland).

Claims

1. A compound of formula (I)



5 wherein

R¹ represents a C₁₋₄alkoxy group optionally substituted by one or more fluoro or a C₁₋₄alkyl group optionally substituted by one or more fluoro;

n represents 0 or 1;

10 R² represents a C₁₋₄alkyl group optionally substituted by one or more fluoro or a C₁₋₄alkoxy group optionally substituted by one or more fluoro ;

m represents 0 or 1;

R³ represents H or a C₁₋₄alkyl group;

15 L¹ represents an alkylene chain (CH₂)_r in which r represents 2 or 3 or L¹ represents a cyclohexyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclohexyl group either via the 1,3 or the 1,4 positions of the cyclohexyl group or L¹ represents a cyclopentyl group wherein the two nitrogens bearing R³ and R⁴, respectively, are linked to the cyclopentyl group via the 1,3 position of the cyclopentyl group and additionally when R⁵ represents 9, 10-methanoanthracen-9(10H)-yl the group -L¹-N(R⁴)- together represents a piperidyl ring which is linked to L² through the piperidinyll nitrogen and to N-R³ via the 4 position of the piperidyl ring with the proviso that when R⁵ represents 9, 10-methanoanthracen-9(10H)-yl then r is only 2;

20 R⁴ represents H or a C₁₋₄alkyl group optionally substituted by one or more of the following: an aryl group or a heteroaryl group;

L² represents a bond or an alkylene chain (CH₂)_s in which s represents 1, 2 or 3 wherein the alkylene chain is optionally substituted by one or more of the following: a C₁₋₄alkyl group, phenyl or heteroaryl;

R⁵ represents aryl, a heterocyclic group or a C₃₋₈cycloalkyl group which is optionally fused to a phenyl or to a heteroaryl group;

as well as optical isomers and racemates thereof as well as pharmaceutically acceptable salts, thereof;

with a first proviso that when n is 0, and m is 1 and R^2 is methyl located at the 4-position of the quinoline ring, and R^3 is H and R^4 is H and L^1 is $(CH_2)_2$ or $(CH_2)_3$ or 1,4-cyclohexyl, and L^2 is a bond then R^5 is not 4-methylquinolin-2-yl;

and with a second proviso that when n is 0, and m is 0 or 1 and R^2 is a C_{1-3} alkoxy group located at the 4-position of the quinoline ring, and R^3 is H or a C_{1-3} alkyl group and R^4 is H or a C_{1-3} alkyl group and L^1 is $(CH_2)_3$ and L^2 is methylene optionally substituted by one or more C_{1-3} alkyl groups or phenyl then R^5 is not phenyl, thienyl or indolyl optionally substituted by one, two or three C_{1-4} alkyl groups or halo.

2. A compound as claimed in claim 1 in which R^1 represents a C_{1-4} alkoxy group.

3. A compound as claimed in claim 1 or claim 2 in which R^2 represents a C_{1-4} alkyl group.

4. A compound as claimed in any previous claim in which L^1 represents trimethylene, 1,3-cyclohexyl or 1,4-cyclohexyl or when R^5 represents 9, 10-methanoanthracen-9(10H)-yl L^1 additionally represents ethylene.

5. A compound as claimed in any previous claim in which L^1 represents trimethylene.

6. A compound as claimed in any previous claim in which L^1 represents 1,3-cyclohexyl.

7. A compound as claimed in any previous claim in which L^1 represents 1,4-cyclohexyl.

8. A compound as claimed in any previous claim in which L^1 represents 1,3-cyclopentyl.

9. A compound as claimed in any previous claim in which R^3 represents H.

10. A compound as claimed in any previous claim in which L^2 represents methylene.

11. A compound as claimed in any previous claim in which R^4 represents H.

12. A compound as claimed in any previous claim in which R^5 represents phenyl, 2-naphthyl or 9, 10-methanoanthracen-9(10H)-yl, each of which is optionally substituted by one or more of the following: methyl, chloro, dimethylamino or phenyl.

13. A compound as claimed in any previous claim in which R^5 represents 4, 5, 6, 7-tetrahydrothianaphth-4-yl, benzo[*b*]thien-3-yl, 2-thienyl, 3-thienyl, 2-furyl, 3-furyl, benzofuranyl, pyridyl, 1H-pyrrol-2-yl, 1H-indol-3-yl, or 2-quinoliny, each of which is optionally substituted by one or more of the following: nitro, methyl, acetyl or chloro.

14. A compound selected from:

N-(9, 10-methanoanthracen-9(10H)-ylmethyl)-*N'*-(2-quinoliny)-1, 2-ethanediamine;

N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-(3-thienylmethyl)-1, 3-propanediamine;

- N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(2-quinoliny)-*N'*-(3-thienylmethyl)-1, 3-propanediamine;
N-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinoliny)-1, 4-cyclohexanediamine;
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methyl-2-quinoliny)-1, 3-
5 propanediamine;
N-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(2-quinoliny)-1, 3-cyclohexanediamine;
N-(2-quinoliny)-*N'*-[1-(3-thienyl)ethyl]-1, 3-propanediamine;
N-(2-quinoliny)-*N'*-(3-thienylmethyl)-1, 3-cyclohexanediamine;
10 *N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-(6-methoxy-4-methyl-2-quinoliny)-1, 3-propanediamine;
N-(2-quinoliny)-*N'*-(4, 5, 6, 7-tetrahydrothianaphth-4-yl)-1, 3-propanediamine;
N-methyl-*N'*-(2-quinoliny)-*N*-(3-thienylmethyl)-1, 3-propanediamine;
N-(2-quinoliny)-*N'*, *N'*-bis(3-thienylmethyl)-1, 3-propanediamine;
15 *N*-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(2-quinoliny)-*N'*-(2, 4, 6-trimethylphenyl)methyl]-1, 3-propanediamine;
N-(2-phenylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(1-benzo[*b*]thien-3-ylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
20 *N*-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 3-cyclohexanediamine;
N-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-*N'*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(2-quinoliny)-*N'*-(2-thienylmethyl)-1, 3-propanediamine;
N-(3-furanylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
25 *N*-[(3, 4-dichlorophenyl)methyl]-*N*-methyl-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-[1-(9, 10-methanoanthracen-9(10*H*)-ylmethyl)-4-piperidinyl]-2-quinolinamine;
N-(1*H*-indol-3-ylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(2-naphthalenylmethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-(2, 2-diphenylethyl)-*N'*-(2-quinoliny)-1, 3-propanediamine;
30 *N*-(1*H*-indol-3-ylmethyl)-*N'*-(6-methoxy-4-methyl-2-quinoliny)-1, 3-propanediamine;
N-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 3-propanediamine;
N-[(3, 4-dichlorophenyl)methyl]-*N'*-(2-quinoliny)-1, 4-cyclohexanediamine;

- N, N'*-di-(2-quinoliny)-1,3-propanediamine;
N-(2-quinoliny)-*N'*-(2-quinolinylmethyl)-1,3-propanediamine;
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-(cyclopropylmethyl)-*N'*-(2-quinoliny)-1,3-propanediamine;
5 *N*-(2-quinoliny)-*N'*-(3-thienylmethyl)-1,4-cyclohexanediamine;
N-([1,1'-biphenyl]-4-ylmethyl)-*N'*-(2-quinoliny)-1,3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-[3-(5-methyl-2-furanyl)butyl]-1,3-propanediamine;
N-[[4-(dimethylamino)phenyl]methyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
10 *N*-(1*H*-pyrrol-2-ylmethyl)-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[3-(5-methyl-2-furanyl)butyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[(5-nitro-3-thienyl)methyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-[(5-nitro-3-thienyl)methyl]-1,3-propanediamine;
N-(6-methoxy-4-methyl-2-quinoliny)-*N'*-(1*H*-pyrrol-2-ylmethyl)-1,3-propanediamine;
15 *N*-[(3,4-dichlorophenyl)methyl]-*N'*-methyl-*N'*-2-quinoliny)-1,3-propanediamine;
N-[1-(2,5-dimethyl-3-thienyl)ethyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[1-(2,5-Dichloro-thiophen-3-yl)-ethyl]-*N'*-(2-quinoliny)-1,3-propanediamine;
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-quinolin-2-ylcyclohexane-1,3-diamine;
N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine;
20 (6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclopentane-1,3-diamine;
(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclopentane-1,3-diamine
(1*S*,3*S*)-*N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclopentane-1,3-diamine
25 diamine
N-[(1-acetyl-1*H*-indol-3-yl)methyl]-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine;
N-(1*H*-indol-3-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine;
N-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine;
30 *N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-[(1-methyl-1*H*-indol-3-yl)methyl]cyclohexane-1,3-diamine;

N-(1-benzofuran-2-ylmethyl)-*N'*-(6-methoxy-4-methylquinolin-2-yl)cyclohexane-1,3-diamine; *N*-(6-methoxy-4-methylquinolin-2-yl)-*N'*-(pyridin-2-ylmethyl)cyclohexane-1,3-diamine and

N-(4-methylquinolin-2-yl)-*N'*-(3-thienylmethyl)cyclohexane-1,3-diamine;

5 as well as pharmaceutically acceptable salts thereof.

15. A compound of formula I as claimed in any previous claim for use as a medicament.

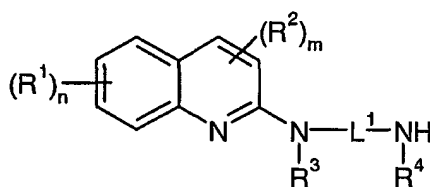
16. A pharmaceutical formulation comprising a compound of formula I, as defined in any one of claims 1 to 14 and a pharmaceutically acceptable adjuvant, diluent or carrier.

17. Use of a compound of formula I, as defined in any one of claims 1 to 14 in the
10 preparation of a medicament for the treatment or prophylaxis of conditions associated with obesity.

18. A method of treating obesity, psychiatric disorders, anxiety, anxio-depressive disorders, depression, bipolar disorder, ADHD, cognitive disorders, memory disorders, schizophrenia, epilepsy, and related conditions, and neurological disorders and pain related
15 disorders, comprising administering a pharmacologically effective amount of a compound as claimed in any one of claims 1 to 14 to a patient in need thereof.

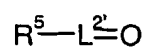
19. A compound as defined in any one of claims 1 to 14 for use in the treatment of obesity.

20. A process for the preparation of compounds of formula I comprising reacting a compound of formula II



II

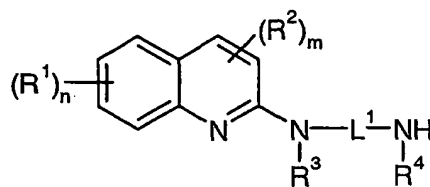
in which R^1 , R^2 , R^3 , R^4 , L^1 , n and m are as previously defined with a compound of formula
III



III

in which R^5 is as previously defined and $L^{2'}$ represents a group which after reaction of
 5 compounds II and III gives L^2 on reduction, under reductive alkylation conditions.

21. Intermediates of formula II



II

in which R^1 , R^2 , R^3 , R^4 , L^1 , n and m are as defined in claim 1.

INTERNATIONAL SEARCH REPORT

Internat. Classification No.
PCT/GB 03/02884

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K31/47 C07D215/38 C07D409/12 C07D401/12 C07D407/12
A61K31/4709 A61P3/04 A61P25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07D A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

CHEM ABS Data, EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 55677 A (SMITHKLINE BEECHAM PLC, UK) 4 November 1999 (1999-11-04) cited in the application examples 1A,27A,29A,33B,62D ---	1,21
X	WO 97 43278 A (NOVO NORDISK A/S, DEN.; ANKERSEN, MICHAEL; STIDSEN, CARSTEN ENNGAARD; A) 20 November 1997 (1997-11-20) example 4 --- -/-	21

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

17 September 2003

Date of mailing of the international search report

06/10/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3015

Authorized officer

Schmid, J-C

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/02884

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 17267 A (ZYMOGENETICS, INC., USA;OSTEOSCREEN, INC.) 30 April 1998 (1998-04-30) page 5, line 29 see formula (viii) page 29, line 15 page 29, line 19 claims 37,38 figures 141,144 ----	1,15
X	WO 99 65897 A (CHIRON CORPORATION, USA) 23 December 1999 (1999-12-23) example 12 page 1, line 8 - line 13 ----	1-21
X	US 3 020 283 A (SCHOCK, RICHARD U., JR. ET AL) 6 February 1962 (1962-02-06) cited in the application claim 1 ----	1,15
P,X	WO 02 058702 A (SMITHKLINE BEECHAM CORPORATION, UK) 1 August 2002 (2002-08-01) cited in the application claims; examples ----	1-21
P,A	EP 1 285 651 A (TAKEDA CHEMICAL INDUSTRIES LTD) 26 February 2003 (2003-02-26) the whole document A & WO 01 082925 A 8 November 2001 (2001-11-08) -----	1-21 1-21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/02884

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claim 18 is directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Internatio	lication No
PCT/GB 03/02884	

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9955677	A	04-11-1999	AU 3523599 A BR 9909994 A CA 2330564 A1 CN 1307565 T WO 9955677 A1 EP 1084110 A1 HU 0103093 A2 JP 2002513005 T NO 20005400 A PL 343680 A1 TR 200003170 T2 US 6320051 B1 ZA 200005781 A	16-11-1999 26-12-2000 04-11-1999 08-08-2001 04-11-1999 21-03-2001 28-02-2002 08-05-2002 26-10-2000 27-08-2001 22-01-2001 20-11-2001 04-06-2001
WO 9743278	A	20-11-1997	AU 2764797 A WO 9743278 A1 EP 0912551 A1 JP 2001525793 T US 6159941 A US 6127343 A ZA 9704147 A	05-12-1997 20-11-1997 06-05-1999 11-12-2001 12-12-2000 03-10-2000 14-11-1997
WO 9817267	A	30-04-1998	AU 4988997 A EP 0973513 A1 JP 2001510450 T WO 9817267 A1 US 5948776 A US 5965573 A US 5990169 A US 5939444 A US 5922753 A US 6017940 A US 6153631 A US 6342514 B1 US 5919808 A US 6251901 B1 US 5994358 A	15-05-1998 26-01-2000 31-07-2001 30-04-1998 07-09-1999 12-10-1999 23-11-1999 17-08-1999 13-07-1999 25-01-2000 28-11-2000 29-01-2002 06-07-1999 26-06-2001 30-11-1999
WO 9965897	A	23-12-1999	AU 4956699 A CN 1312807 T EP 1087963 A1 WO 9965897 A1 US 2003130289 A1 US 6417185 B1 US 6489344 B1	05-01-2000 12-09-2001 04-04-2001 23-12-1999 10-07-2003 09-07-2002 03-12-2002
US 3020283	A	06-02-1962	NONE	
WO 02058702	A	01-08-2002	WO 02058702 A1	01-08-2002
EP 1285651	A	26-02-2003	AU 5259601 A CA 2407149 A1 EP 1285651 A1 WO 0182925 A1 JP 2002241274 A	12-11-2001 08-11-2001 26-02-2003 08-11-2001 28-08-2002